Nokia Customer Care

Service Manual

RM-640; RM-662 (Nokia C3-01; Nokia C3-01m)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	10/2010	Jeff Zhao	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

Please state:

- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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Nokia C3-01; Nokia C3-01m Service Manual Structure

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1 — General information

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Table of Contents

List of Figures

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Product selection

RM–640 (Nokia C3–01) is a GSM/WCDMA dual mode phone, supporting GSM 850/900/1800/1900 and WCDMA 850/900/1900/2100. RM–662 (Nokia C3–01m) surports GSM 850/900/1800/1900.

Figure 1 RM–640/RM–662 (Nokia C3–01/Nokia C3–01m) product picture

Phone features

Hardware features

- Protocols: WCDMA 850/900/1900/2100MHz (RM-640 only),
  GSM 850/900/1800/1900MHz
  Variant 2: GSM 850/900/1800/1900MHz
- Power class: : WCDMA class 3 (24 dBm) Bands I, V, VIII,
  WCDMA class 4 (21 dBm) Band II,
  EGSM1800/1900 Class 1 (1W 30 dBm),
  EGSM900/850 Class 4 (2W, 33dBm)
- 3GPP: Rel.6
- WCDMA packet data: HSUPA cat 5 up to 2 Mbps;
  HSDPA cat 9 up to 10.2 Mbp
- Speech Codecs: WB-AMR, HR, FR, EFR
- SIM: 1.8V & 3V, up to 2000 entries
- Display: QVGA 262k colors, 2.4” touch
- Camera: 5Mpx full focus + integrated flash

- Music player: MP3, MP4 (audio) = M4A (Container for audio-formats: AAC, MP3), AAC, AAC LC, AAC+, eAAC+, WMA, NRT, MXMF, WAV, NB AMR, WB AMR, MIDI
- Video player: H.263 level 45, MPEG4 encoding + decoding in QCIF resolution (simple profile, level 0b); H. 264/MPEG-4 AVC
- Streaming: Real time & 3GPP streaming
- Keymat: ITU-T keymat
- Side keys: Volume keys, lock key, camera key
- Other keys: Messaging key
- Vibra: Internal
- Speakers: Integrated handsfree, mono speaker
- Radio: Stereo FM radio w RDS
- Interfaces: Micro USB AB connector/charger plug, 2mm DC charging plug, 3.5mm AV connector, Bluetooth version 2.1+EDR, microSD memory card
- Ringing: 99 Phon from 10cm distance
- Lanyard detail: Yes
- Memory: 2000 phonebook entries (max 13 MB), Calendar entries, around 30MB free user memory, MicroSD card up to 32GB.

Bearers supported

EDGE (EGPRS): MSC 33, DTM GRPS/EGPRS MSC 32,

WCDMA, GSM/EGSM, EGPRS/GPRS Rel. 6

HSPA

Stereo BT

High Speed USB (FS/HS/OTG)

WLAN 802.11b/g/n

Language support

Language packs (incl predictive text) for SEAP, China, Europe, Middle East,LTA, India and Africa, handwriting recognition for Chinese language.

Software and user interface features

Applications/Service Enablers

OMA DRM 2.0, WM DRM 10

OMA MMS 1.3, MMS Conformance 3.0, AMR and SMIL

OMA Client Provisioning v1.1

Audio messaging,

JSR 75, JSR, 82, JSR118, JSR135, JSR139, JSR172, JSR177, JSR179, JSR184, JSR185, JSR205, JSR211, JSR226, JSR234, JSR248 (Subset compliance) and NokiaUI proprietary API.

Support for background running (up to 8 manufacturer or operator signed) MIDlets, RMS size max = 512kB per file - up to 2000 files, JAR size max = 1024k - no limit for pre-installed MIDlets, Heap = 2048k, Background heap = 2048k, HTTP(S) +up- and download streaming, TCP/IP, UDP, SSL, TLS

Nokia Messaging Service 3.0 including Push email with attachments: IMAP4, POP3, SMTP 3GPP H.263 playback + streaming. H.264 + MPEG4 video and playback.

Instant Messaging.

SyncML (local and remote)
OMA Device Management 1.2 and FOTA with FUMO 1.0
Nokia OSS Internet Browser (WAP 2.0 XHTML)
Ovi Store 1.7, Macromedia Flash Lite 3.0

UI features

- Series 40/SPR 9.2/Touch

Enhancements

- Battery: BL-5CT, 1050 mAh (inbox)
- Chargers: AC-8 (in-box), AC-15 (inbox in some countries)
- Car solutions: HF-510, HF-200
- MicroSD cards: MU-37, MU-41, MU-43, MU-44
- Wired headset: WH-102 (stereo, inbox)
- Wireless headset (BT): BH-606 (mono), BH-103 (Stereo)
- Music speaker: MD-7W
- Data cables: CA-101D

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
RM-640/RM–662 transceiver with BL-5CT, 1050 mAh Li-Ion battery pack	111 x 47.5 x 10.8	100	51.43

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII/V/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900), WCDMA V (850), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925 - 960 MHz
	WCDMA V (850): 869 - 894 MHz
	WCDMA II (1900): 1930 - 1990 MHz
	WCDMA I (2100): 2110 - 2170 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA V (850): 824 - 849 MHz
	WCDMA II (1900): 1850 - 1910 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01µW ... 251mW
	WCDMA V (850): -50 ... +24 dBm/0.01µW ... 251mW
	WCDMA II (1900): -50 ... +21 dBm/0.01µW ... 126mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251mW
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 501mW
	EDGE900: +5 ... +27dBm/3.2mW ... 501mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 398mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 398mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA V (850): 108
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA V and II 100/200 kHz)

Parameter	Unit
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA V (850): 75
	WCDMA II (1900): 72
	WCDMA I (2100): 75

Battery endurance

Battery	Talk time (2G/3G)	Standby time (2G/3G)	Video playback	Music playing
BL-5CT, 1050 mAh Li-ion	GSM: up to 6.4 h WCDMA: up to 4 h	GSM: up to 525 h WCDMA: up to 477 h	up to 8 h	up to 20 h

Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	

Environmental condition	Ambient temperature	Notes
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

2 — Service Devices and Service Concepts

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Table of Contents

List of Tables

List of Figures

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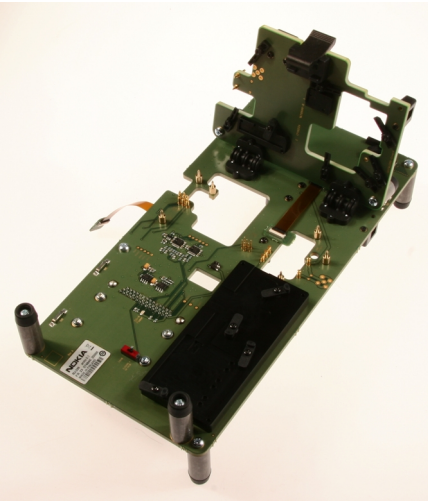
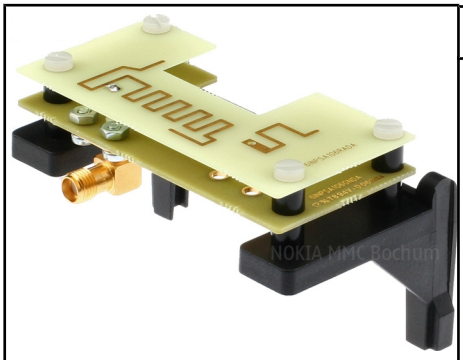
Service devices

Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-640; RM-662. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">  </td><td>FS-159</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-159 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2">  </td><td>MJ-289</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-289 is meant for component level troubleshooting.
The jig includes an Bluetooth. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• MMC interface
• Duplicated SIM connector
• Connector for control unit
• Access for AV- and USB connectors</td></tr>
</table>



SA-106	RF coupler	

SA-106 is an RF coupler for WCDMA and GSM RF testing. It is used together with SS-62.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-106:

Frequency	Attenuation. (dB)
GSM850 TX	Low:-10.4 Mid:-10.0 High:-10.0
GSM850 RX	Low:-9.0 Mid:-8.5 High:-8.5
GSM900 TX	Low:-8.5 Mid:-8.5 High:-8.5
GSM900 RX	Low:-8.5 Mid:-9.1 High:-10.0
GSM1800 TX	Low:-23.7 Mid:-20.0 High:-18.4
GSM1800 RX	Low:-18.0 Mid:-17.2 High:-16.7
GSM1900 TX	Low:-17.6 Mid:-16.7 High:-16.1
GSM1900 RX	Low:-15.8 Mid:-15.1 High:-14.3
WCDMA band I TX	Low:-15.9 Mid:-15.3 High:-14.7
WCDMA band I RX	Low:-12.3 Mid:-12.2 High:-12.6
WCDMA band II TX	Low:-17.5 Mid:-16.7 High:-16.1
WCDMA band II RX	Low:-15.8 Mid:-15.1 High:-14.3
WCDMA band VIII TX	Low:-8.5 Mid:-8.5 High:-9.2
WCDMA band VIII RX	Low:-9.0 Mid:-9.0 High:-9.0

General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-640; RM-662. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.

Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

FLS-5	Flash device	

FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.

Note: FLS-5 can be used as an alternative to PK-1.

FPS-21

FPS-21	Flash prommer	

FPS-21 sales package:

- FPS-21 prommer
- AC-35 power supply
- CA-31D USB cable

FPS-21 interfaces:

Front

- Service cable connector

  Provides Flashbus, USB and VBAT connections to a mobile device.
- SmartCard socket

  A SmartCard is needed to allow DCT-4 generation mobile device programming.

Rear

- DC power input

  For connecting the external power supply (AC-35).
- Two USB A type ports (USB1/USB3)

  Can be used, for example, for connecting external storage memory devices or mobile devices
- One USB B type device connector (USB2)

  For connecting a PC.
- Phone connector

  Service cable connection for connecting Flashbus/FLA.
- Ethernet RJ45 type socket (LAN)

  For connecting the FPS-21 to LAN.

Inside

- Four SD card memory slots

  For internal storage memory.

  Note: In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.

PK-1	Software protection key	

PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.

PK-1 is meant for use with a PC that does not have a series interface.

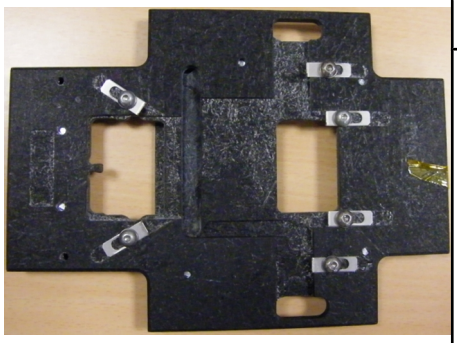
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.

PKD-1	SW security device	

SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.

Without the device, it is not possible to use the service software.

Printer or any such device can be connected to the PC through the device if needed.



RJ-244	Soldering jig	

RJ-244 is a soldering jig used for soldering and as a rework jig for the engine module.

SB-6	Bluetooth test and interface box (sales package)	

The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .

Sales package includes:

- SB-6 test box
- Installation and warranty information

	SB-7	WLAN test box	
	WLAN test requires defined position for the device.		
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers. **Note:** The SRT-6 is included in the Nokia Standard Toolkit.		
SS-46 	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-20/FPS-21.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • multiplexing between USB and FBUS media, controlled by VUSB		
SX-4 	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-20/FPS-21 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-640; RM-662. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CA-101	Micro USB cable	

The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.

CA-158RS	RF tuning cable	

Product-specific adapter cable for RF tuning.

- **Table 1 Attenuation values**

Band	Attenuation Rx/Tx
GSM+WCDMA 850/900	0.2...0.3 dB
GSM+WCDMA 1800/1900	0.3...0.4 dB

CA-31D	USB cable	

The CA-31D USB cable is used to connect FPS-20/FPS-21 to a PC. It is included in the FPS-20/FPS-21 sales packages.

CA-89DS	Cable	
Provides VBAT and Flashbus connections to mobile device programming adapters.		

DAU-9S	MBUS cable	
The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters. **Note:** Docking station adapters valid for DCT4 products.		

PCS-1	Power cable	
The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		

	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WCDMA/WLAN: 0.6+-0.1dB		

Service concepts

POS (Point of Sale) flash concept

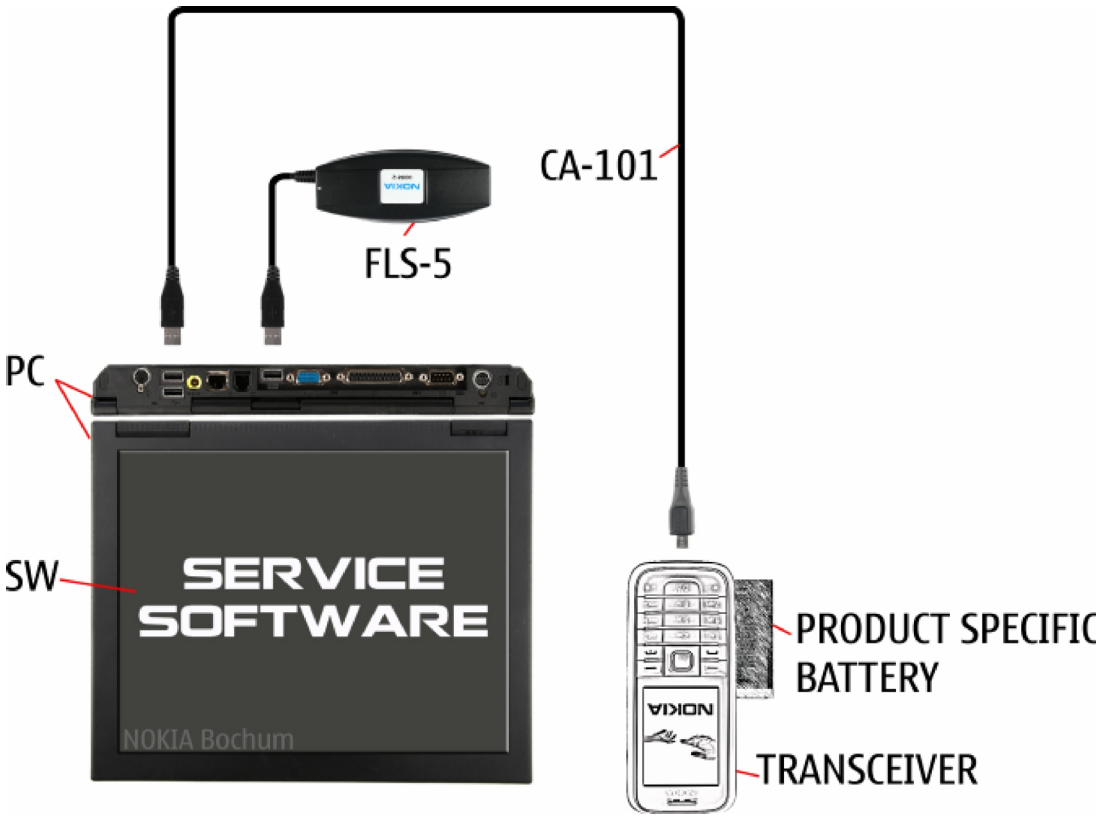


Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-5CT	Battery
Other tools	
FLS-5	POS flash dongle
	PC with service software

Type	Description
Cables	
CA-101	Micro USB cable

Flash concept with FPS-21

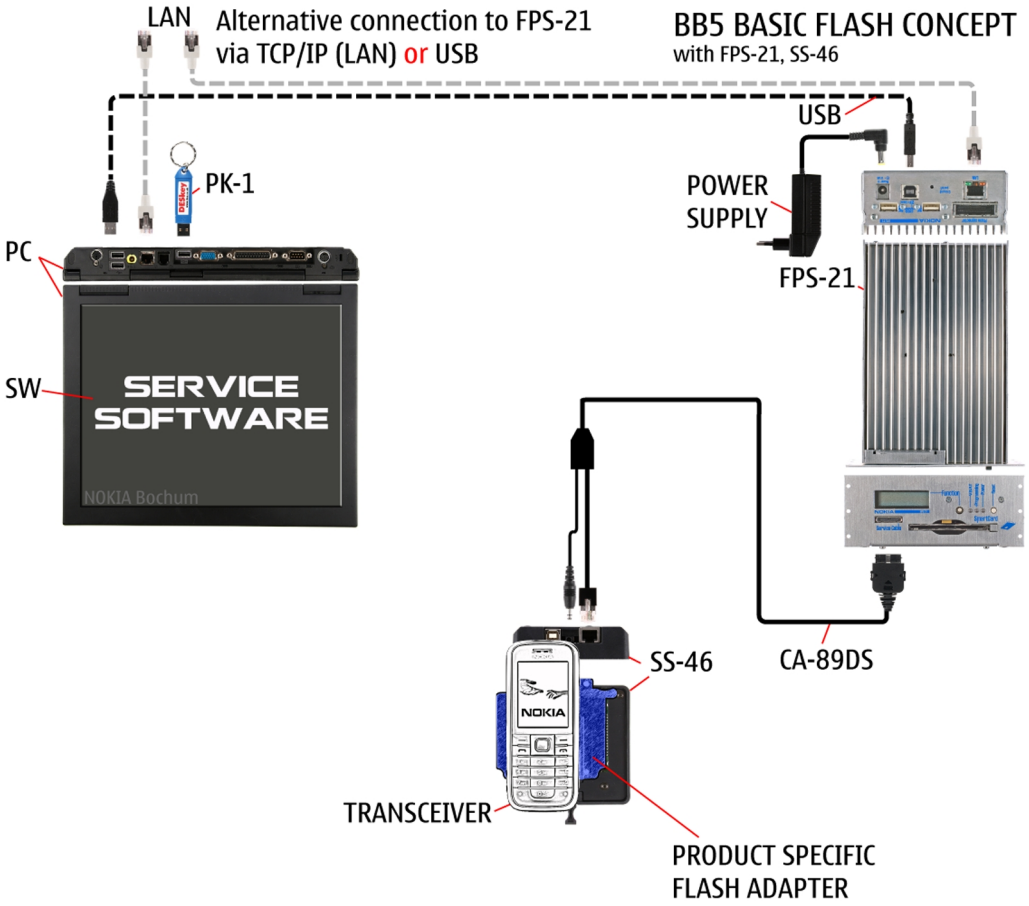


Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS–159	Flash adapter
Other devices	
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Service cable

Type	Description
	USB cable

CU-4 flash concept with FPS-21

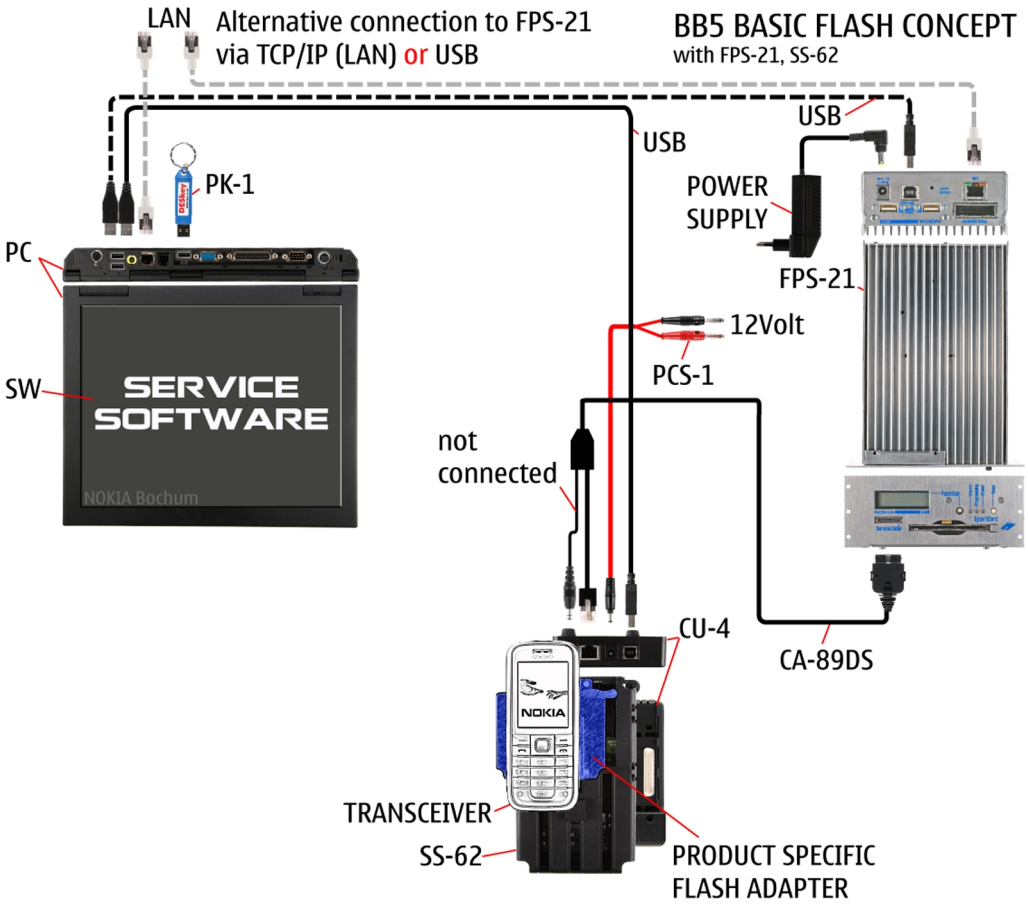


Figure 4 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-159	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card (for DCT-4 generation mobile device programming)
	PC with Phoenix service software
Cables	

Type	Description
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable
	USB cable

Module jig service concept

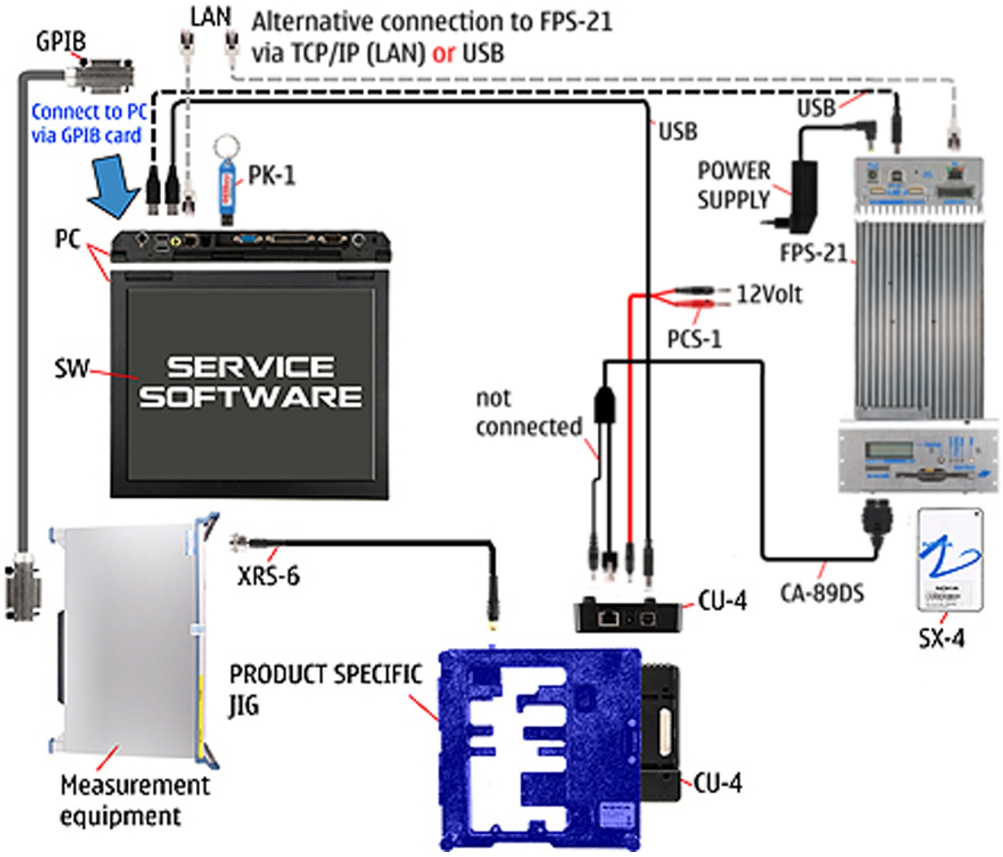


Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-289	Module jig
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
PK-1/PKD-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment

Type	Description
Cables	
CA-89DS	Service cable
PCS-1	DC power cable
XRS-6	RF cable
	USB cable
	GPIB control cable

RF testing concept with RF coupler

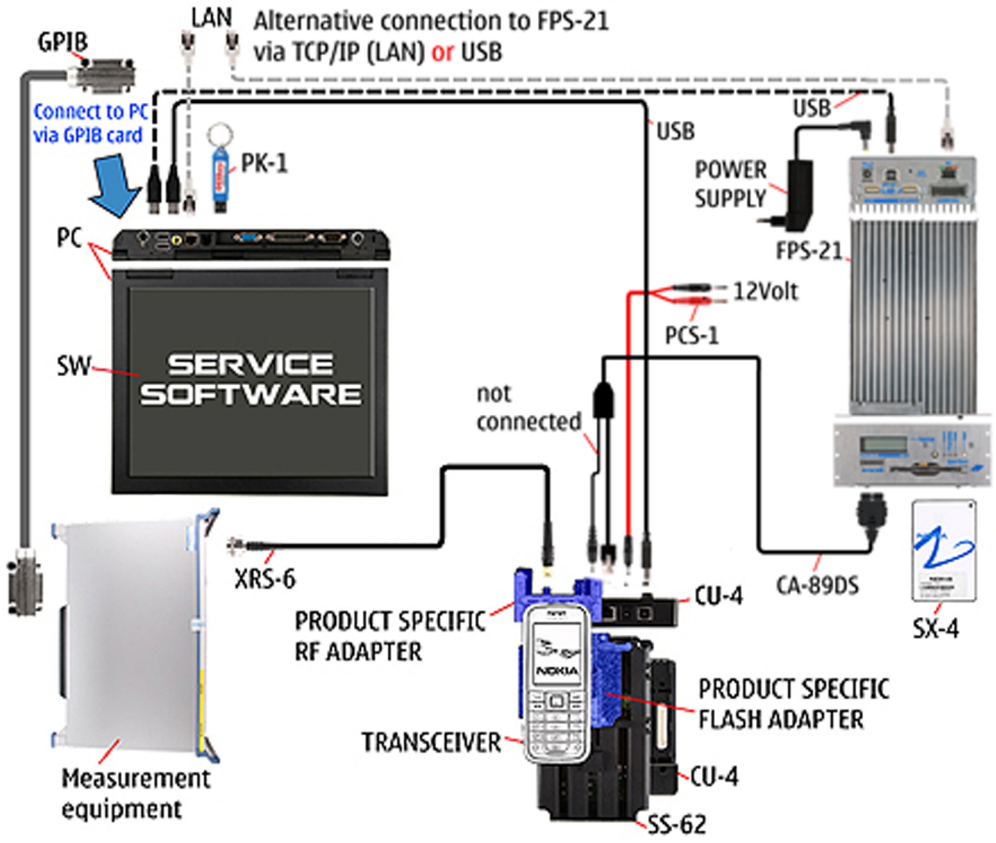


Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-159	Flash adapter
SA-106	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-21	Flash prommer box
PK-1/PKD-1	SW security device

Type	Description
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
CA-89DS	Service cable
PCS-1	Power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

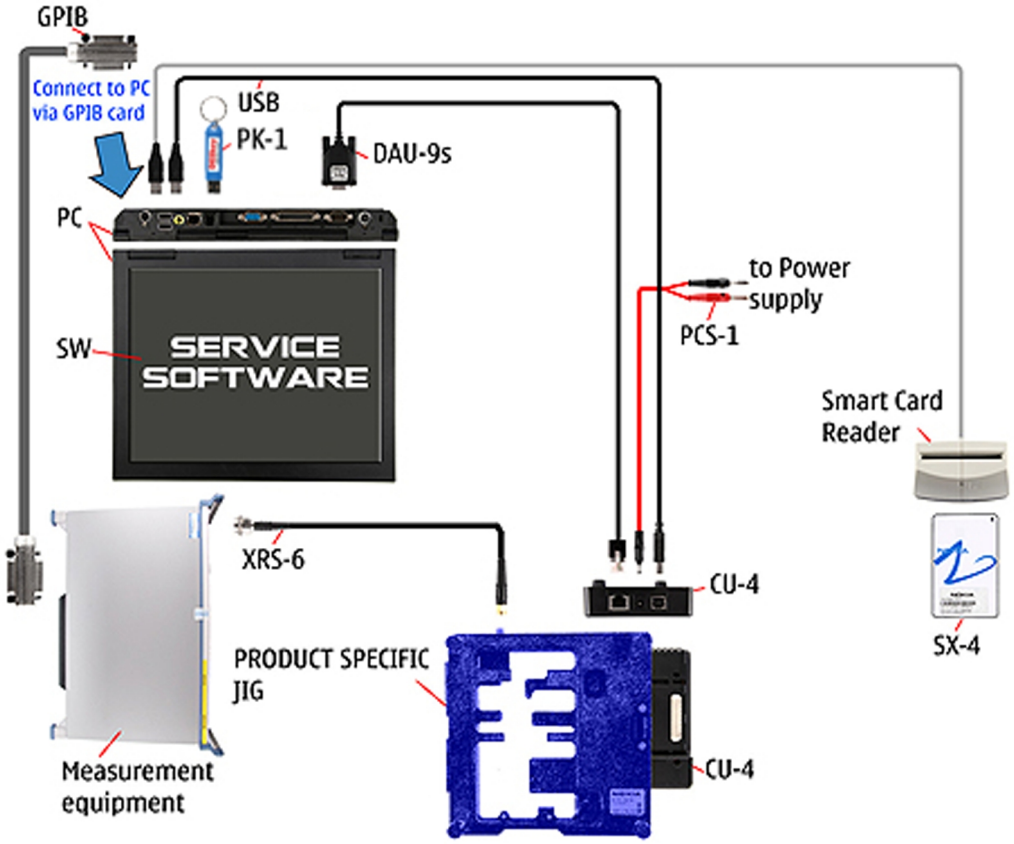


Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-289	Module jig
Other devices	
CU-4	Control unit

Type	Description
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Bluetooth testing concept with SB-6

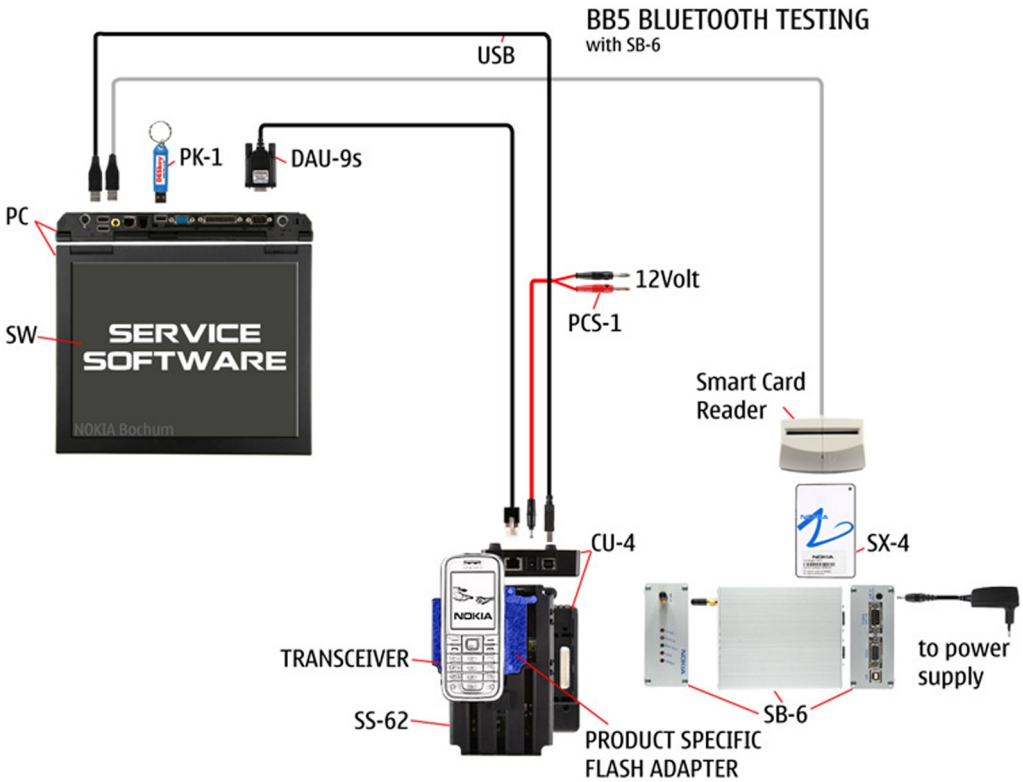


Figure 8 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-159	Flash adapter
Other devices	
CU-4	Control unit

Type	Description
SS-62	Flash adapter base
PK-1	SW security device
SX-4	Smart card
SB-6	Bluetooth test and interface box
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
	USB cable

Level 3 WLAN test concept

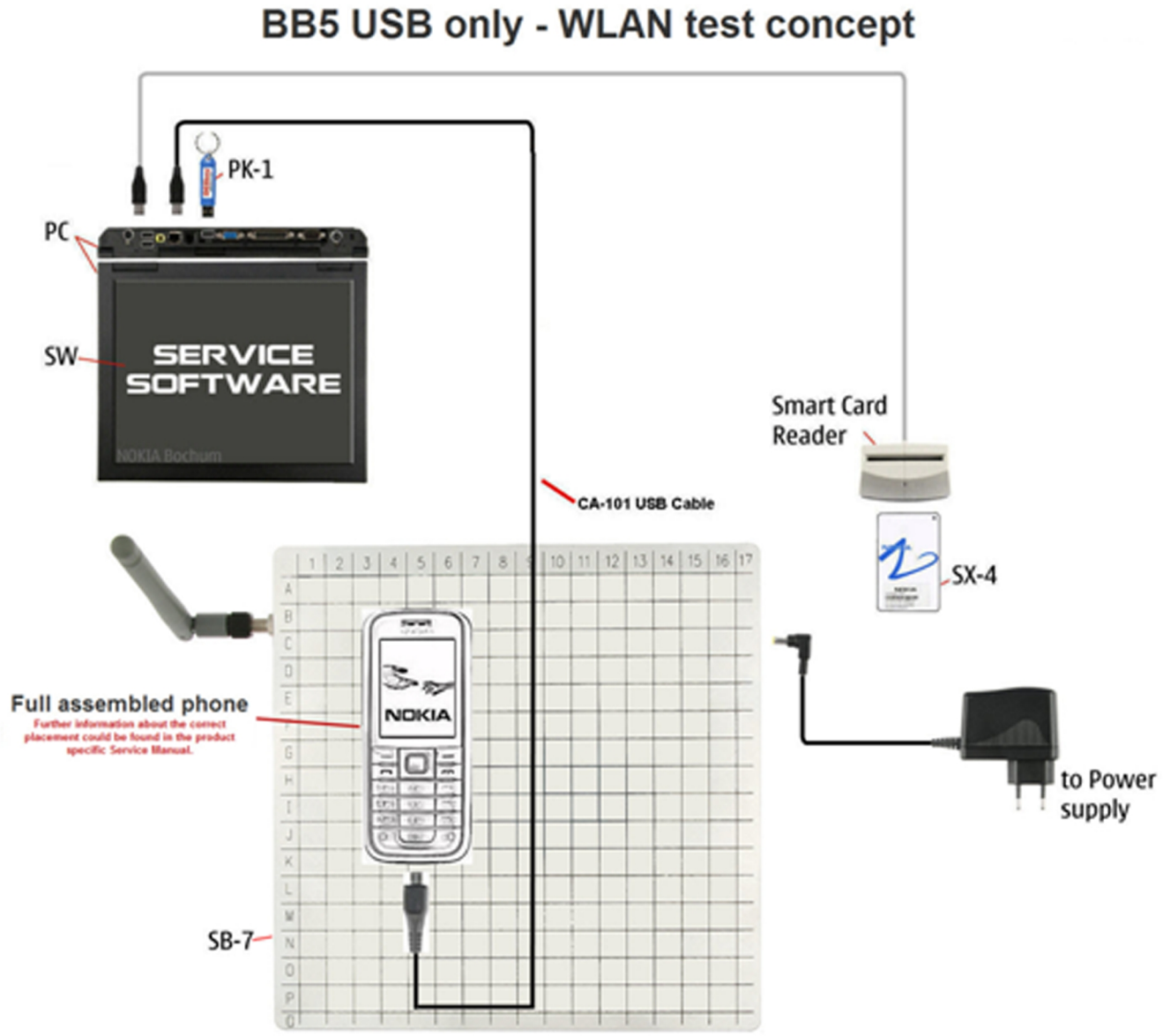


Figure 9 Level 3 WLAN test concept

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3 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

List of Tables

List of Figures

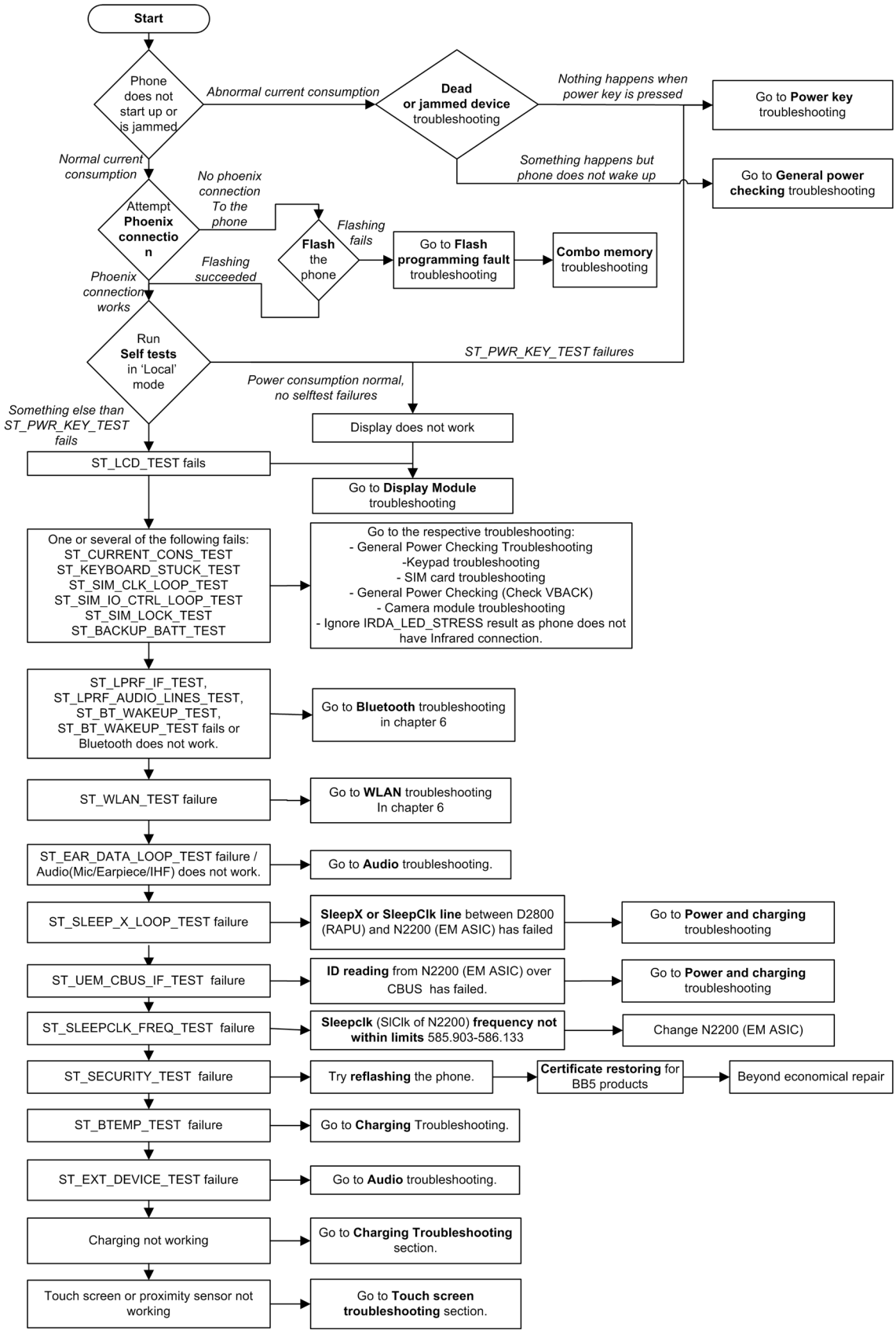
Baseband self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

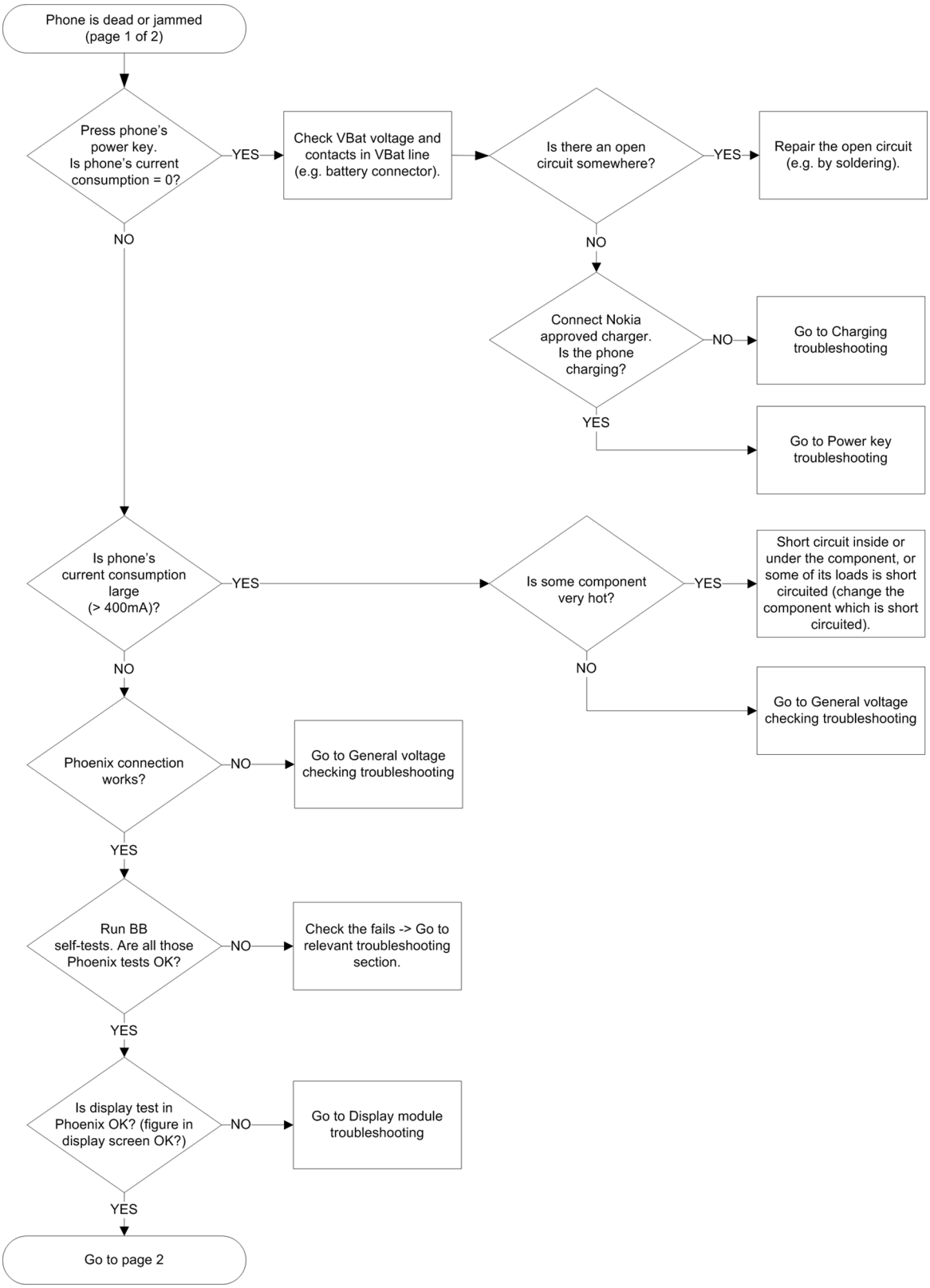
Troubleshooting flow



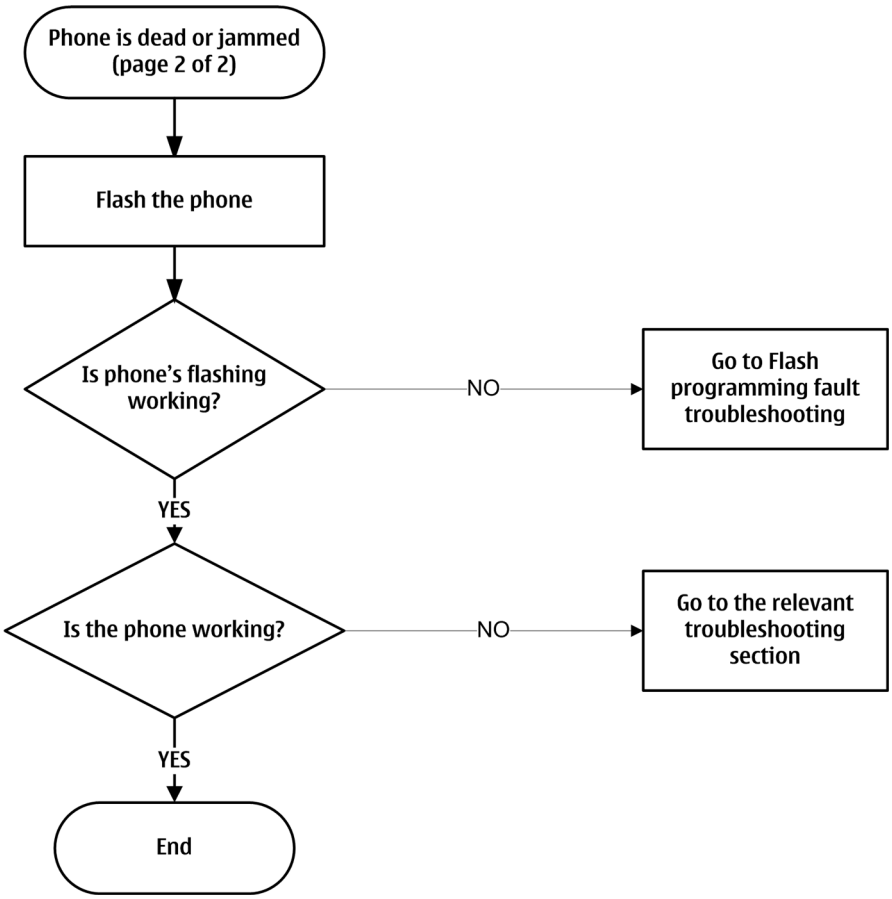
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow - Page 1 of 2

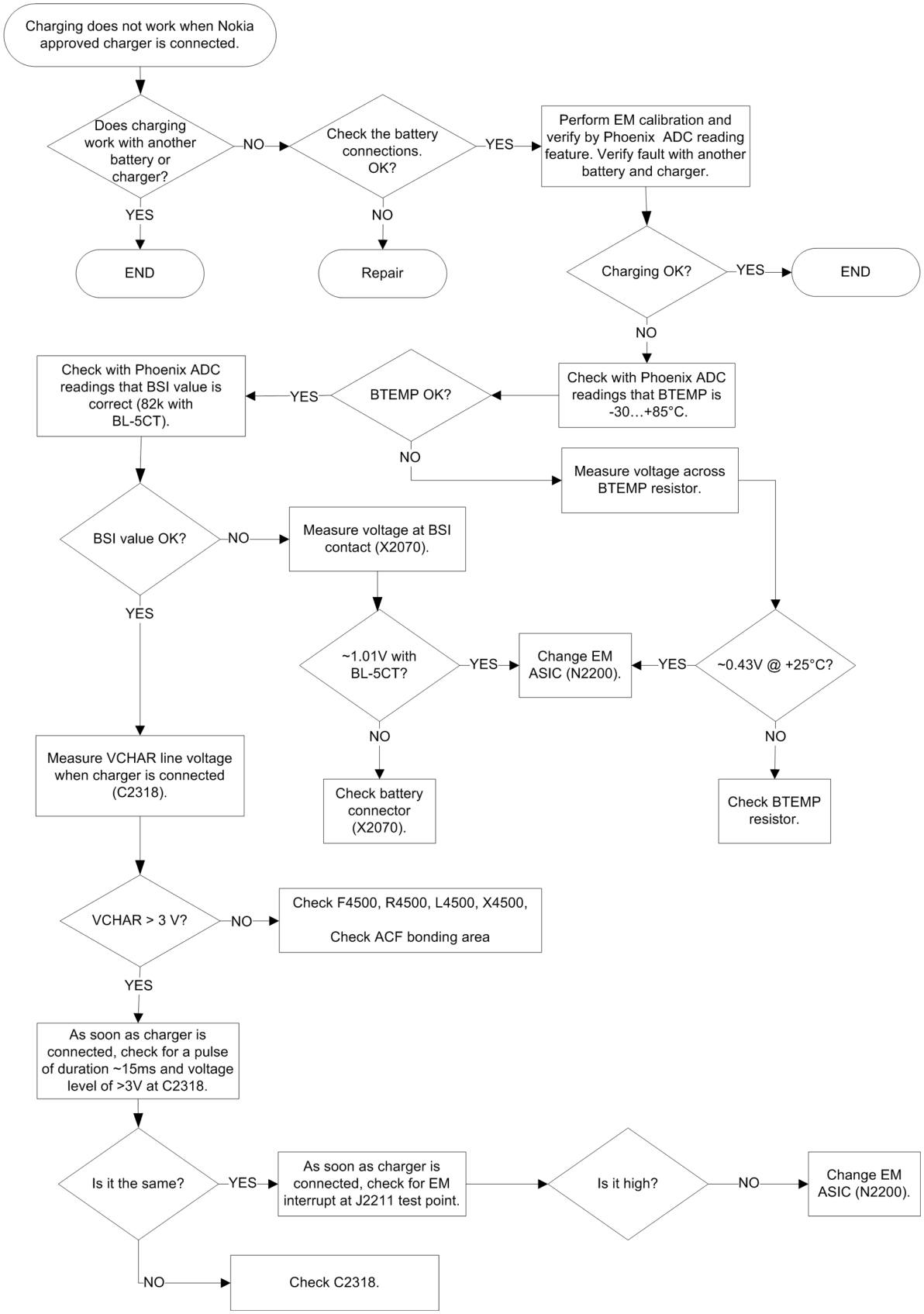


Troubleshooting flow - Page 2 of 2



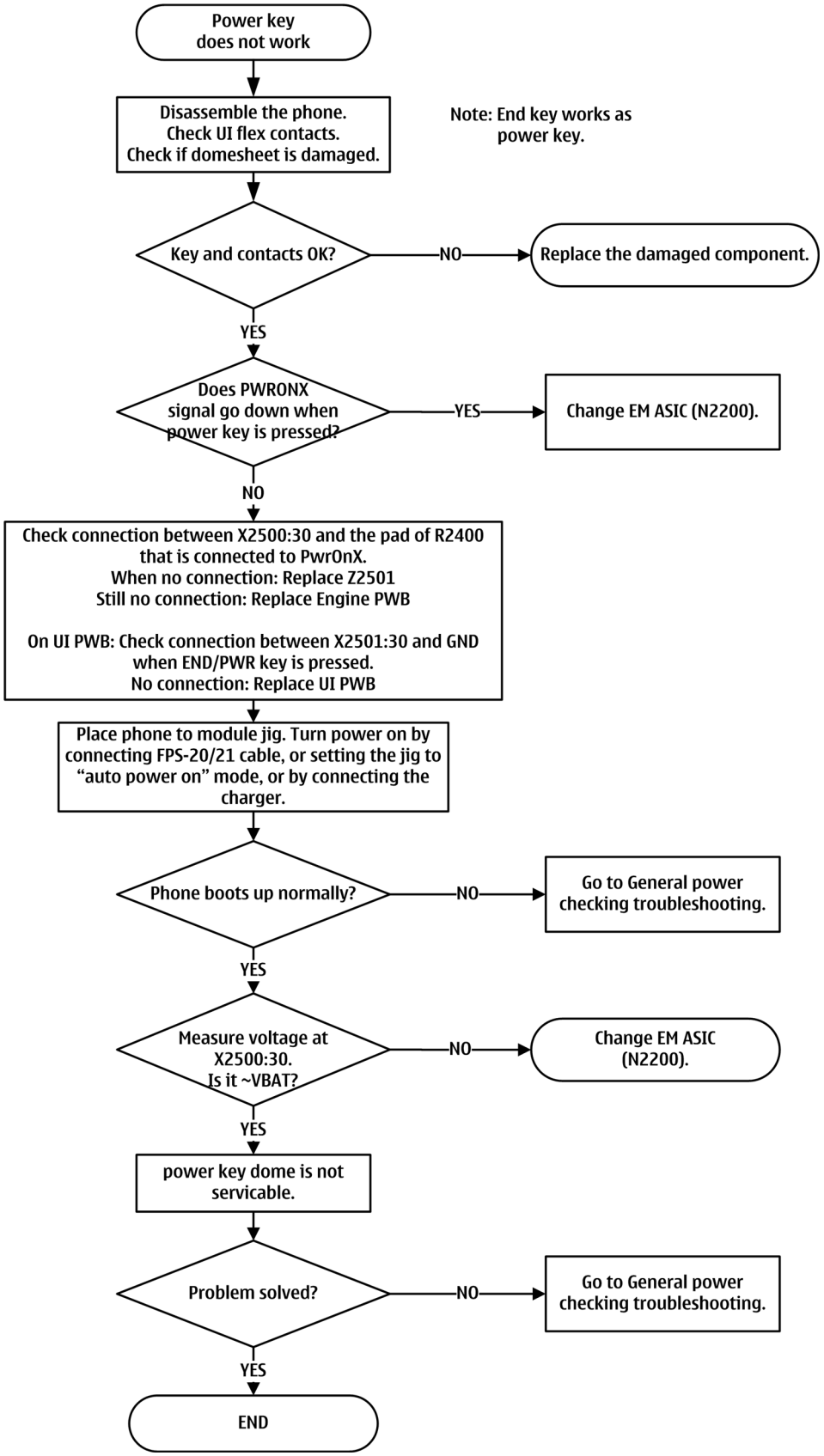
Dynamo charging troubleshooting

Troubleshooting flow



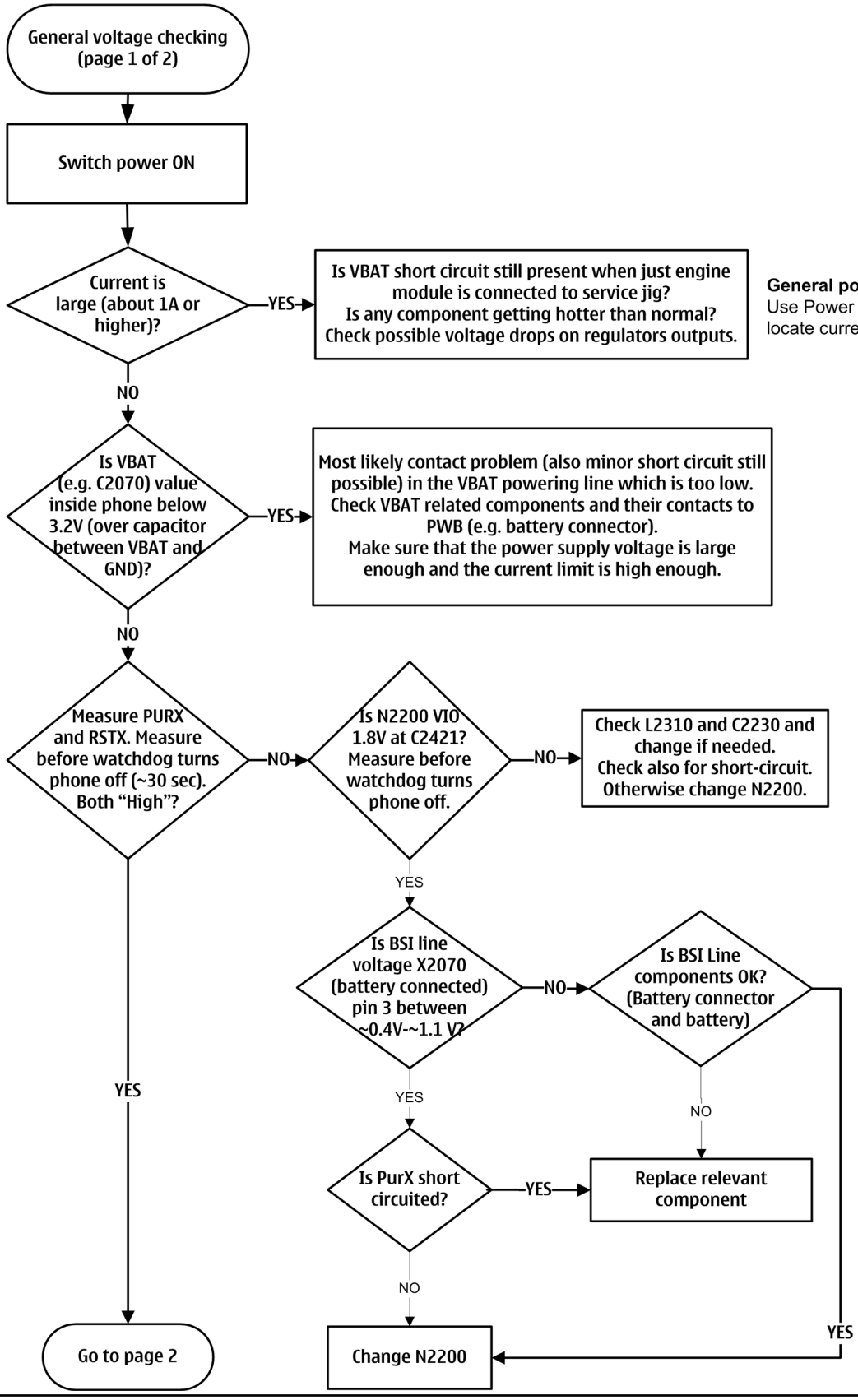
Power key troubleshooting

Troubleshooting flow



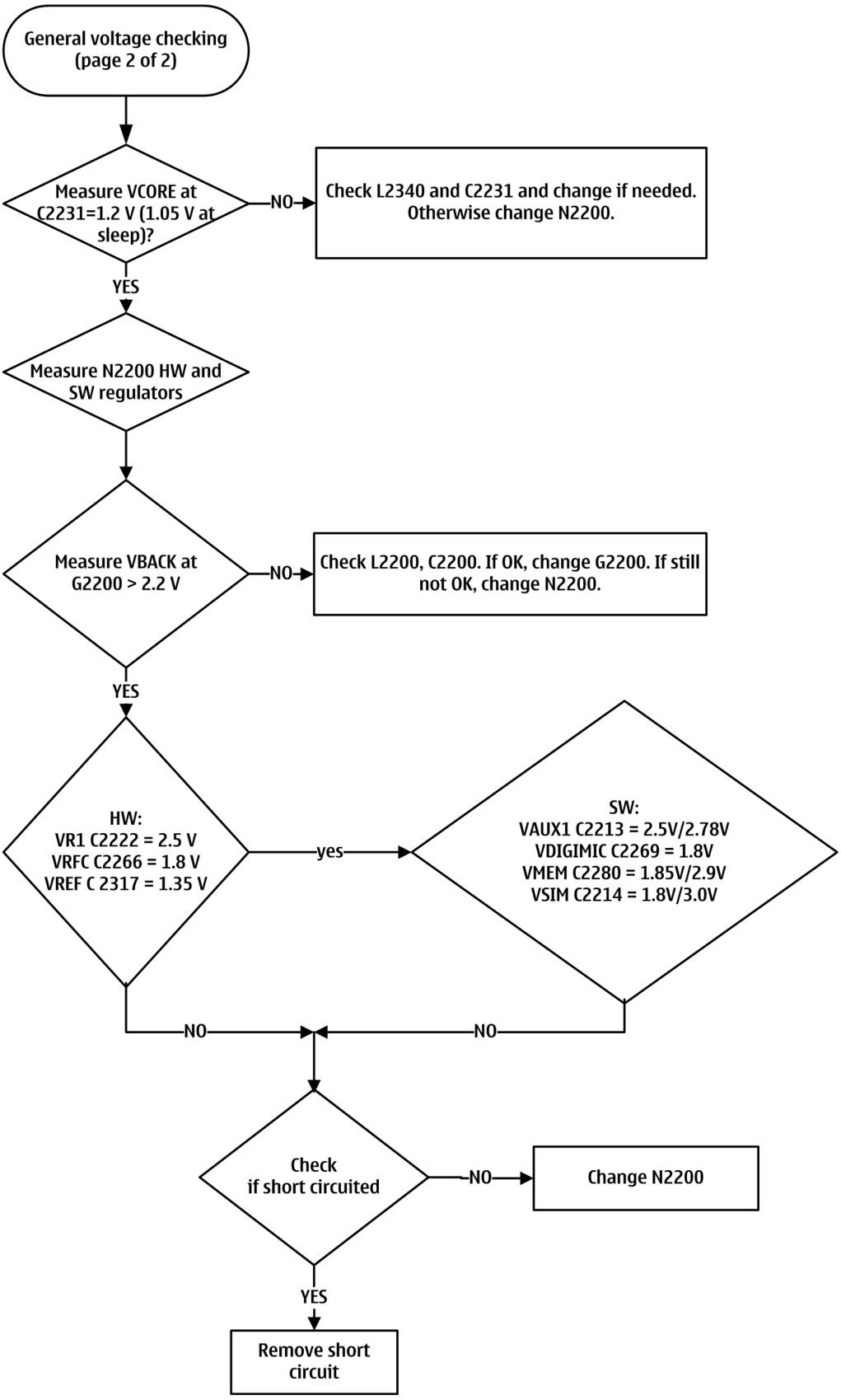
General voltage checking troubleshooting

Troubleshooting flow - Page 1 of 2



General power checking notes:
Use Power distribution diagram to locate current consumption blocks.

Troubleshooting flow - Page 2 of 2



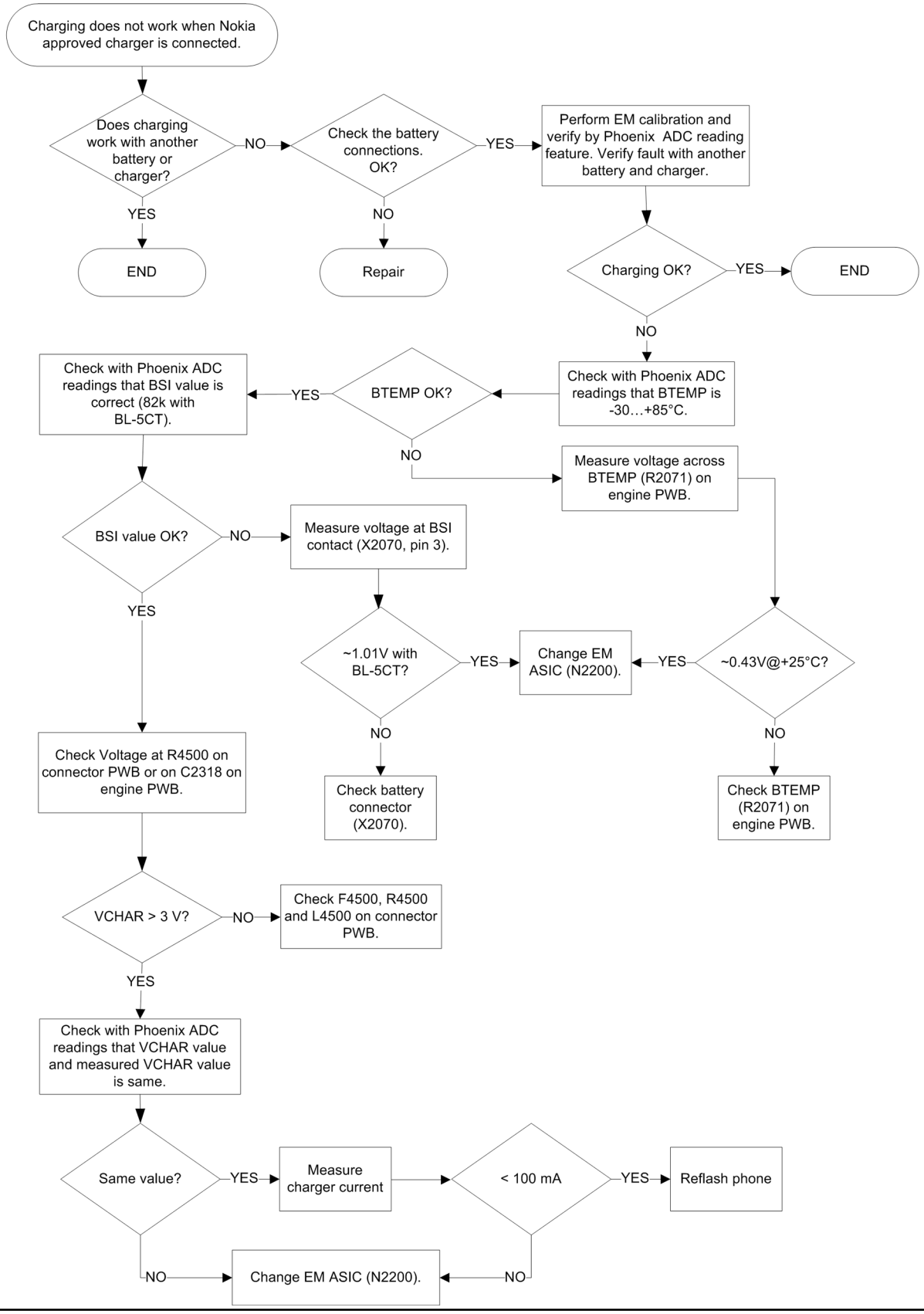
General power checking

Check the following voltages:

Signal Rename	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	Pearl_J/Gazoo	ON	ON	1.8	Memory, I/Os, Display	
VBACK	Pearl/Gazoo	ON	ON	2.5	Back-up battery	
VSIM1	Pearl/Gazoo	ON	ON	1.8/3.0	SIM card	
VAUX1	Pearl/Gazoo	ON	ON	2.8	TV-OUT, 3DFS, MR, Display	
VR1	Pearl/Gazoo	OFF	ON	2.5	Crystal oscillators	
VRFC	Pearl/Gazoo	OFF	ON	1.8	RAPU converters	
VREF	Pearl/Gazoo	ON	ON	1.25	RF reference	
VCORE	Pearl/Gazoo	ON	ON	1.2	RAPU digital	Can change due to RAPU version & SW
VMEM	Pearl/Gazoo	OFF	OFF	2.9	microSD	Disabled in sleep
VDIGIMIC	Pearl/Gazoo	OFF	OFF	1.8	Digimic	

Charging troubleshooting

Troubleshooting flow



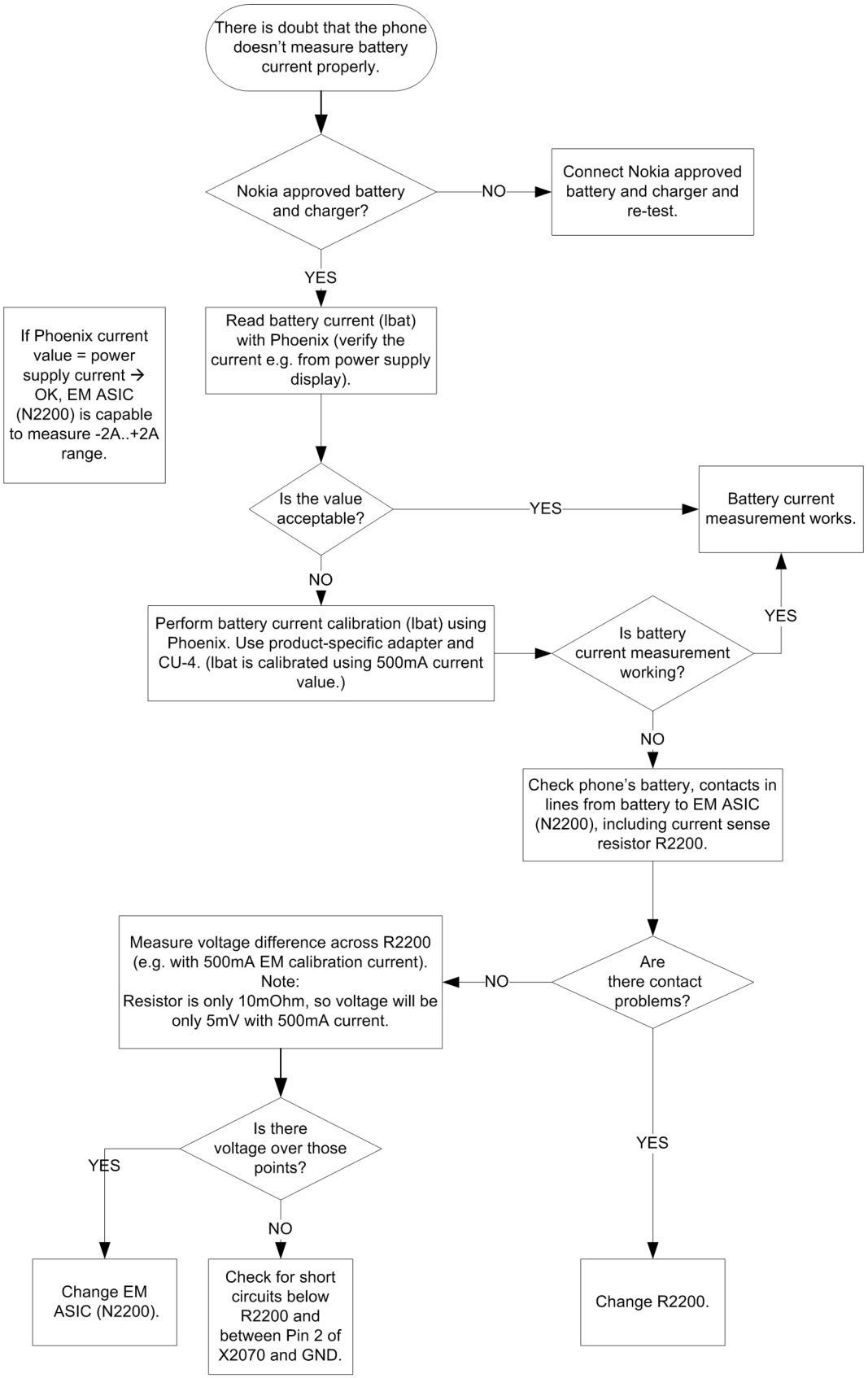
USB charging troubleshooting

Context

For instructions regarding USB charging troubleshooting, see section USB charging troubleshooting (page 3– 0) .

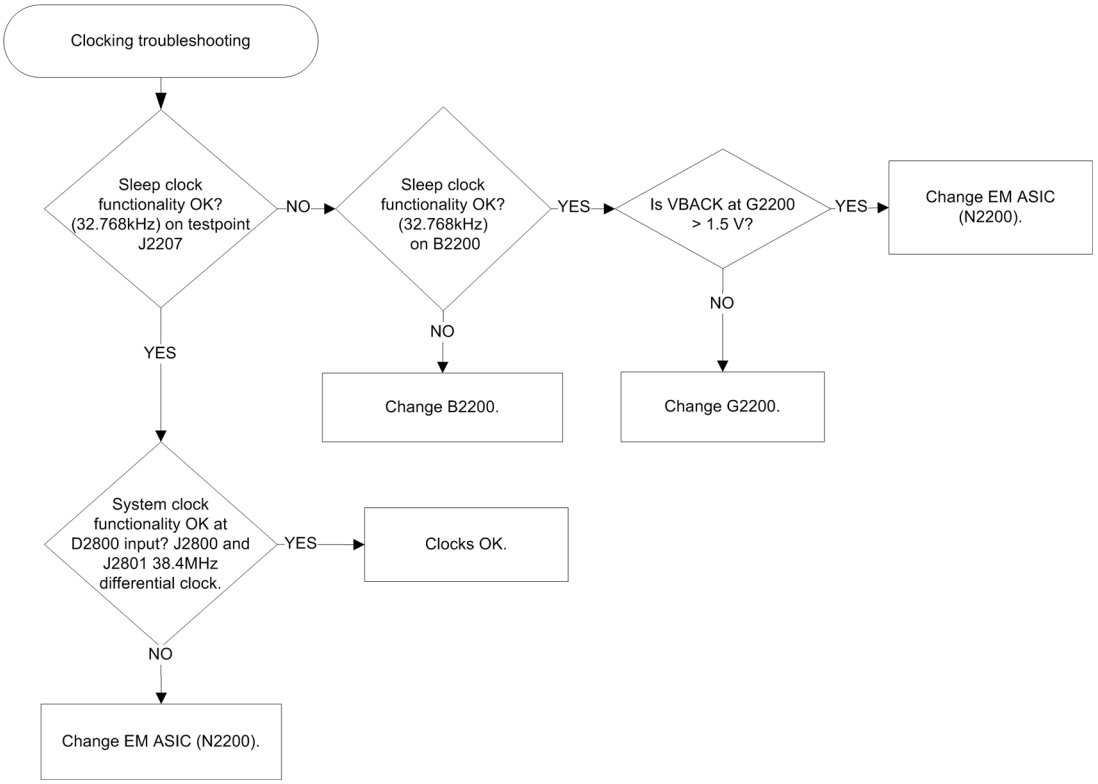
Battery current measuring fault troubleshooting

Troubleshooting flow



Clocking troubleshooting

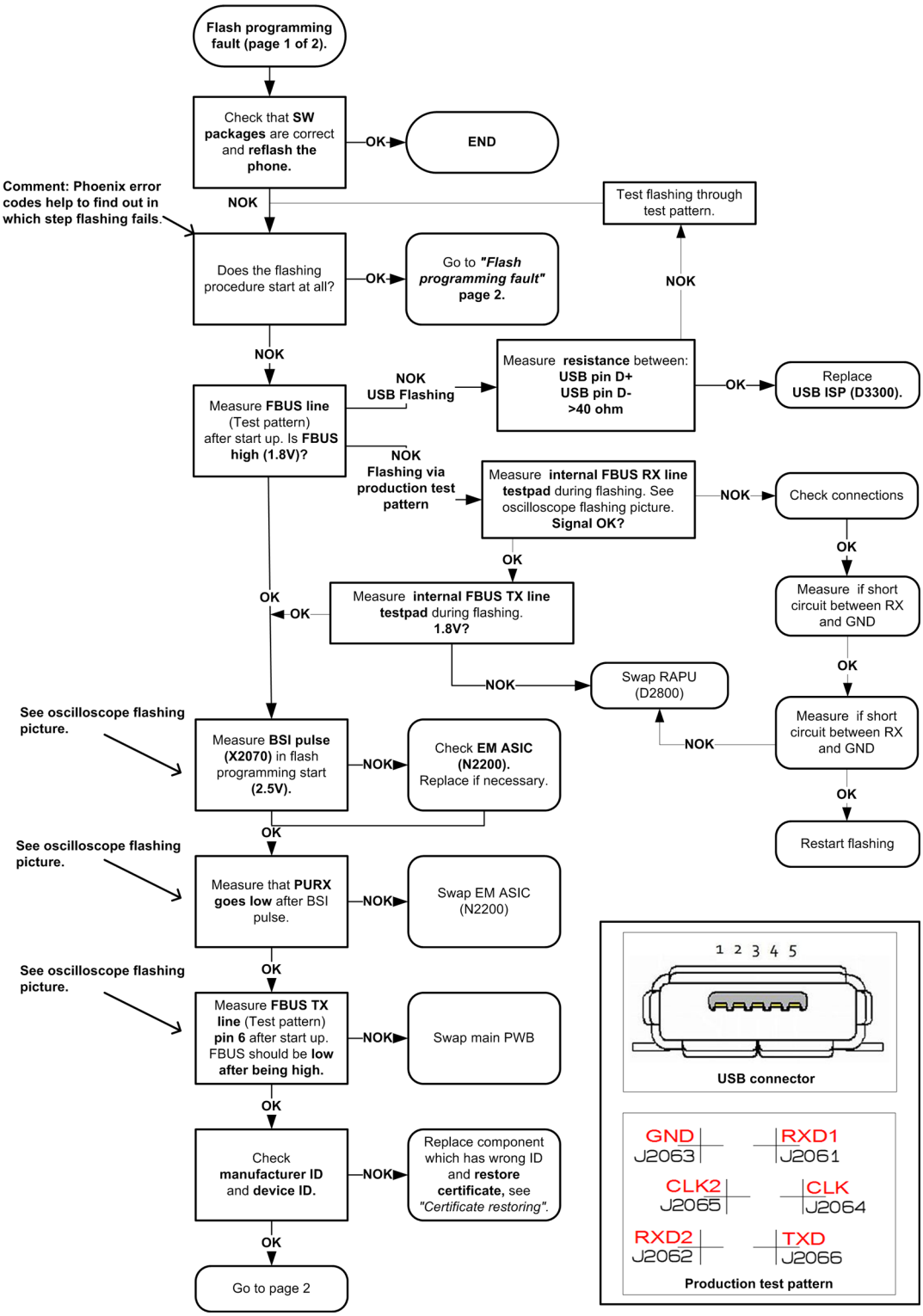
Troubleshooting flow



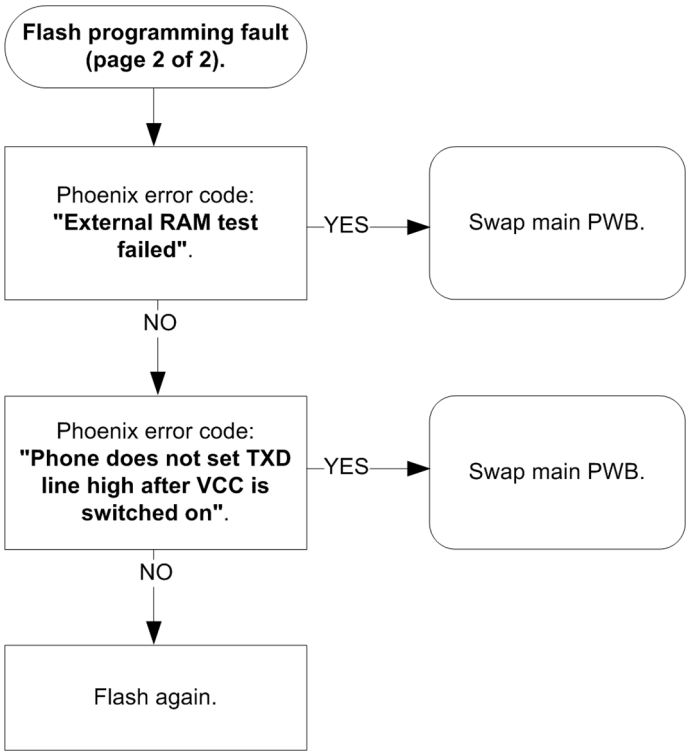
Interface troubleshooting

Flash programming fault troubleshooting

Troubleshooting flow - Page 1 of 2



Troubleshooting flow - Page 2 of 2



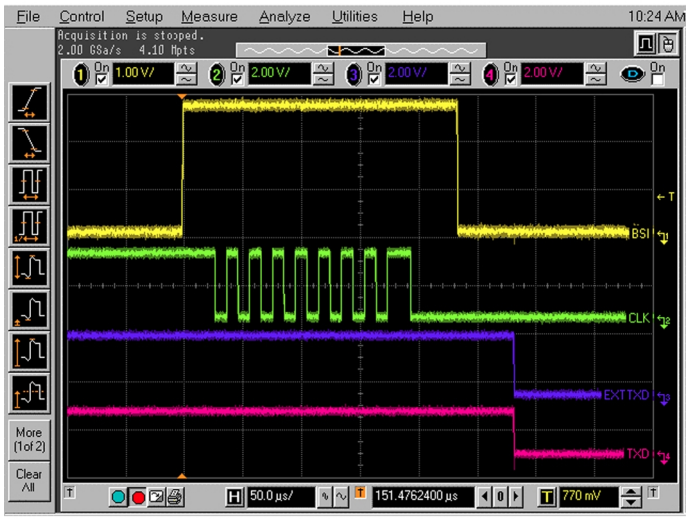


Figure 10 Flashing pic 1. Take single trig measurement for the rise of the BSI signal

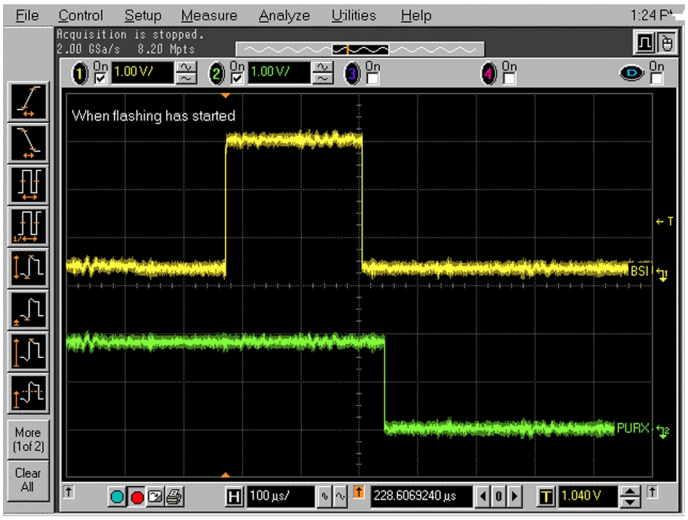
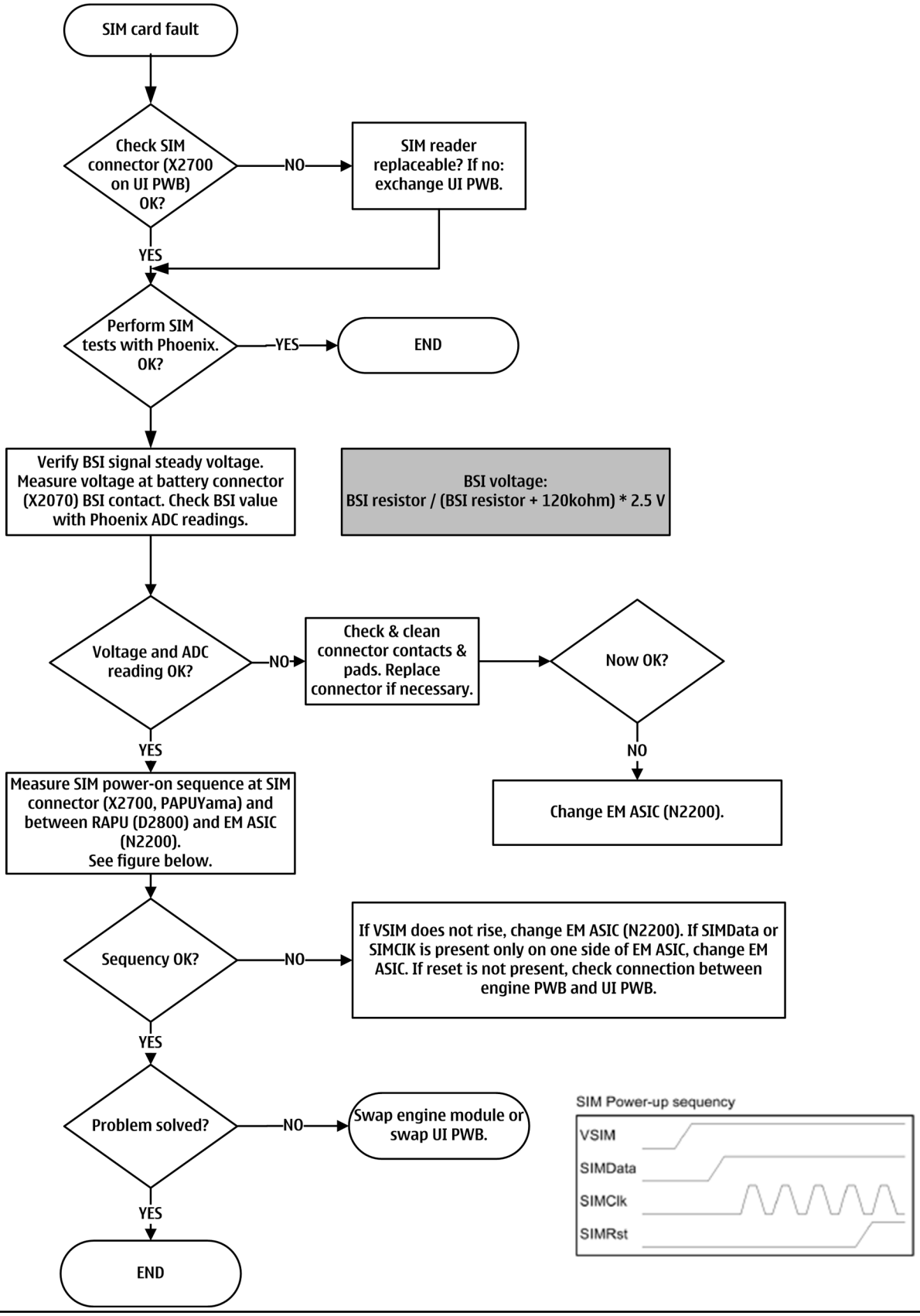


Figure 11 Flashing pic 2. Take single trig measurement for the rise of the BSI signal

SIM card troubleshooting

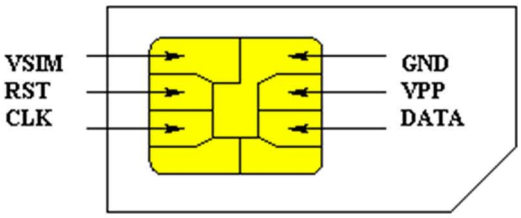
Troubleshooting flow



SIM power-on sequence

Testpoints between
RAPU and EM ASIC
J2218 = SIMData
J2219 = SIMClk
J2220 = SIMIOC

Fsimclk = 3.8MHz



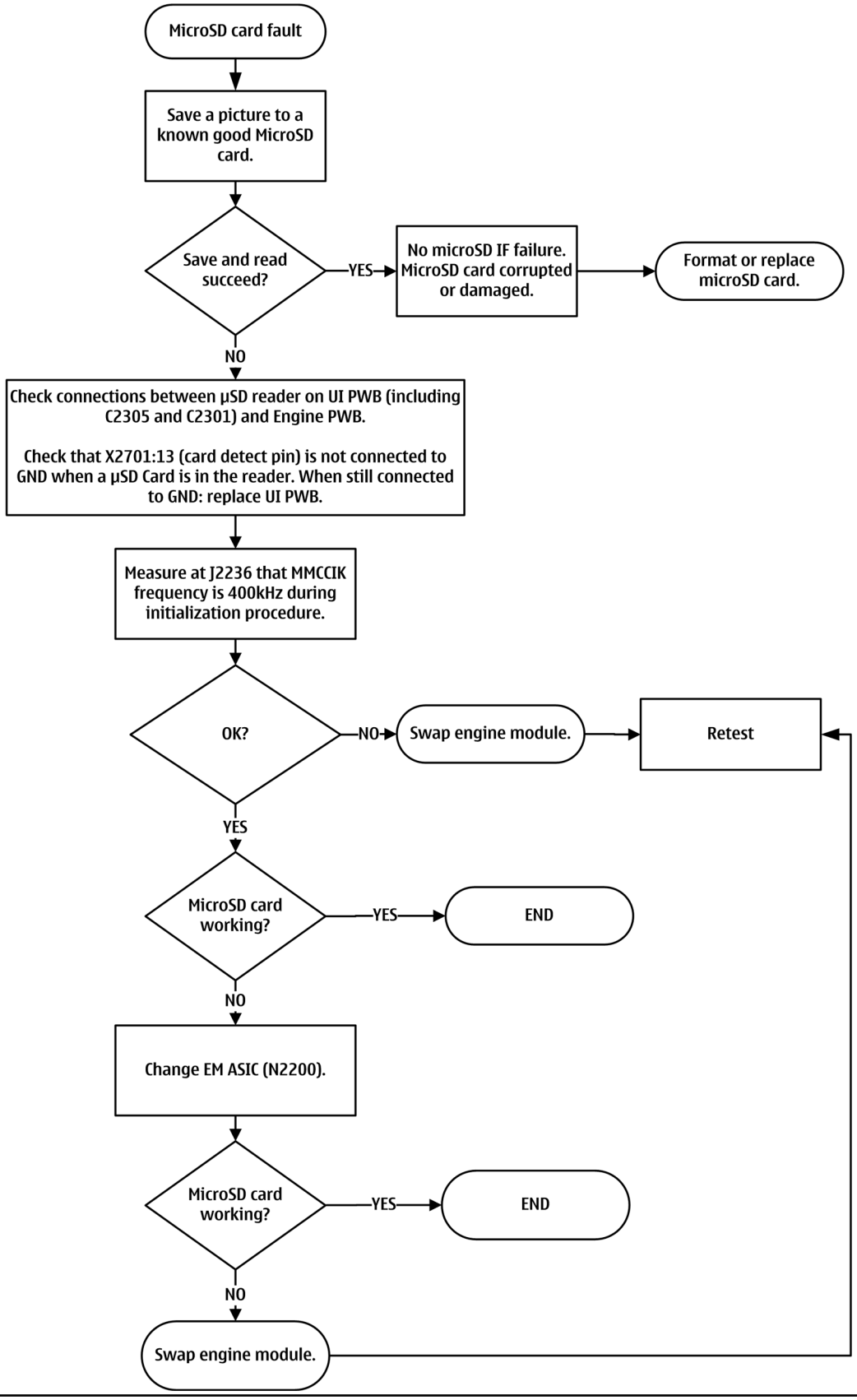
SIM contacts

SIM power-on sequence on X2700.

SIM power-on sequence between RAPU and EM ASIC.

MicroSD card troubleshooting

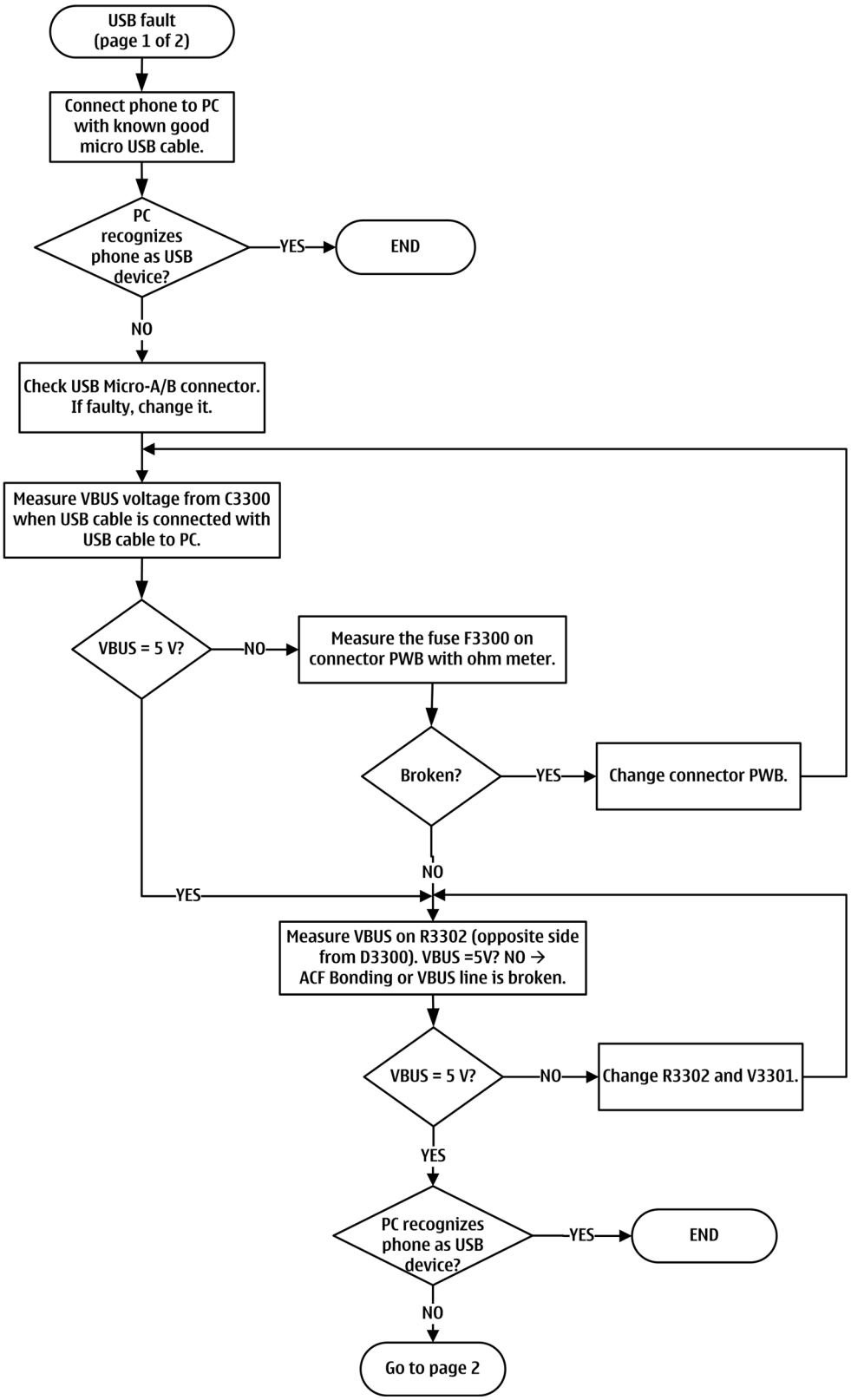
Troubleshooting flow



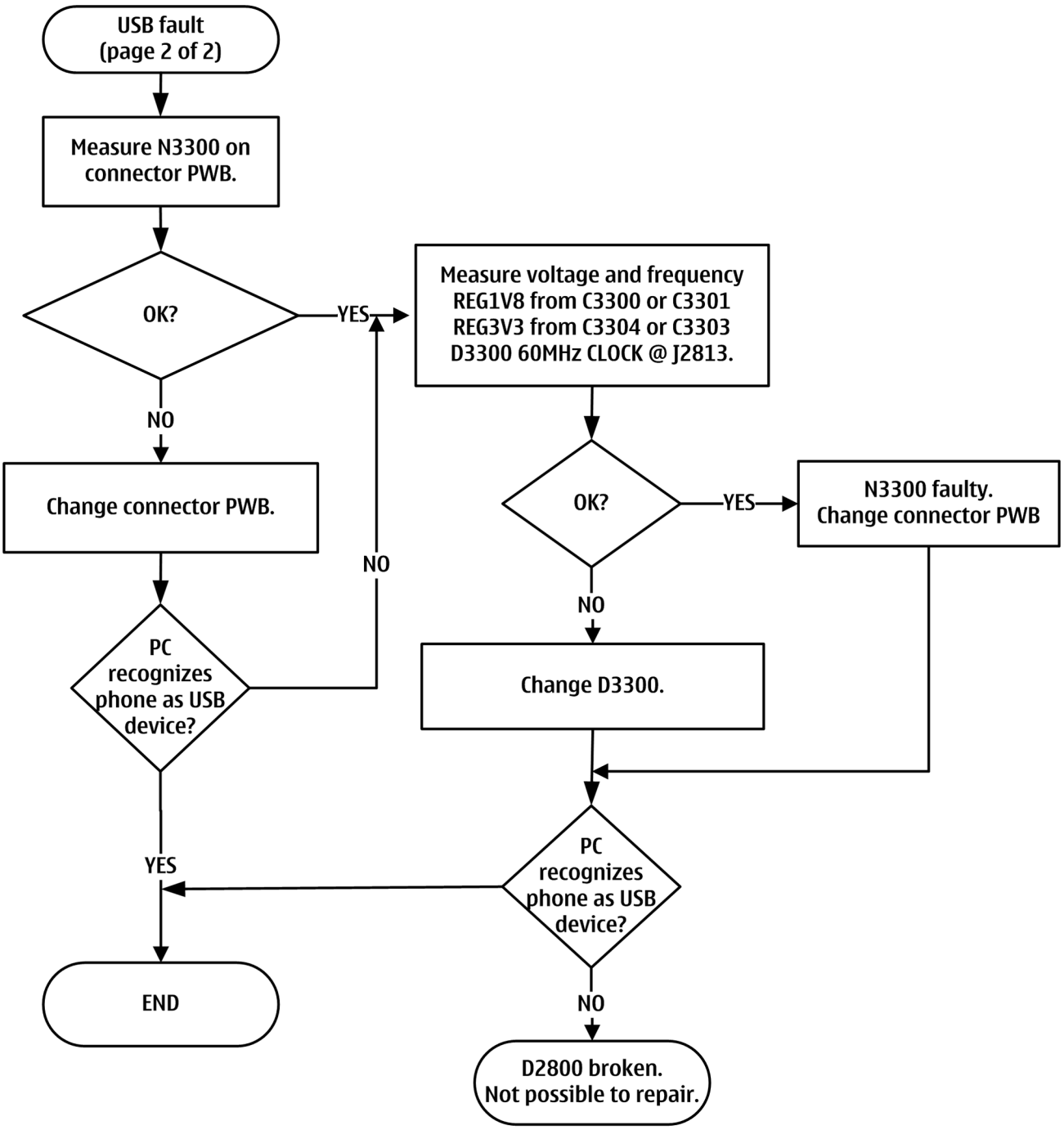
USB troubleshooting

USB data interface troubleshooting

Troubleshooting flow - Page 1 of 2

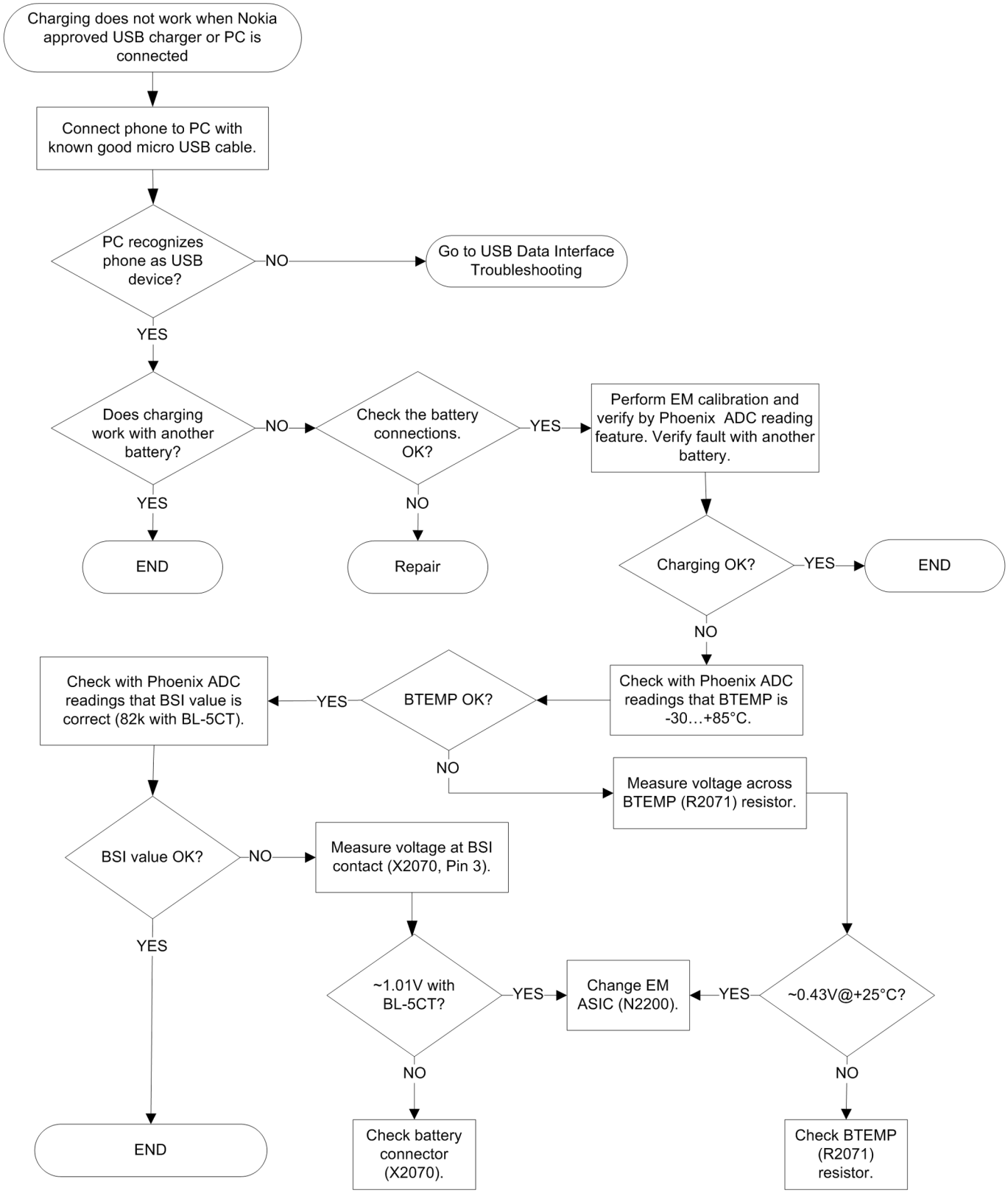


Troubleshooting flow - Page 2 of 2



USB charging troubleshooting

Troubleshooting flow



User interface troubleshooting

Keyboard and side keys troubleshooting

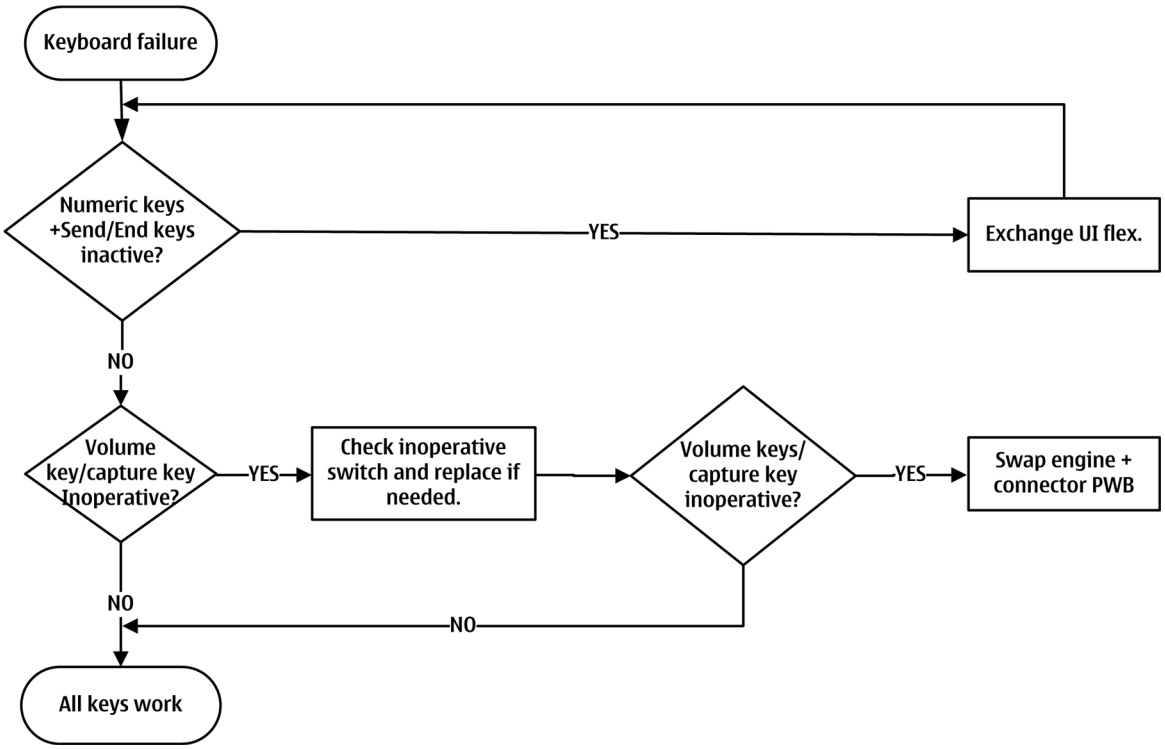
Context

Possible failure mode in the keyboard module:

- One or more keys are stuck, so that the key does not react when a keydome or a side key is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)

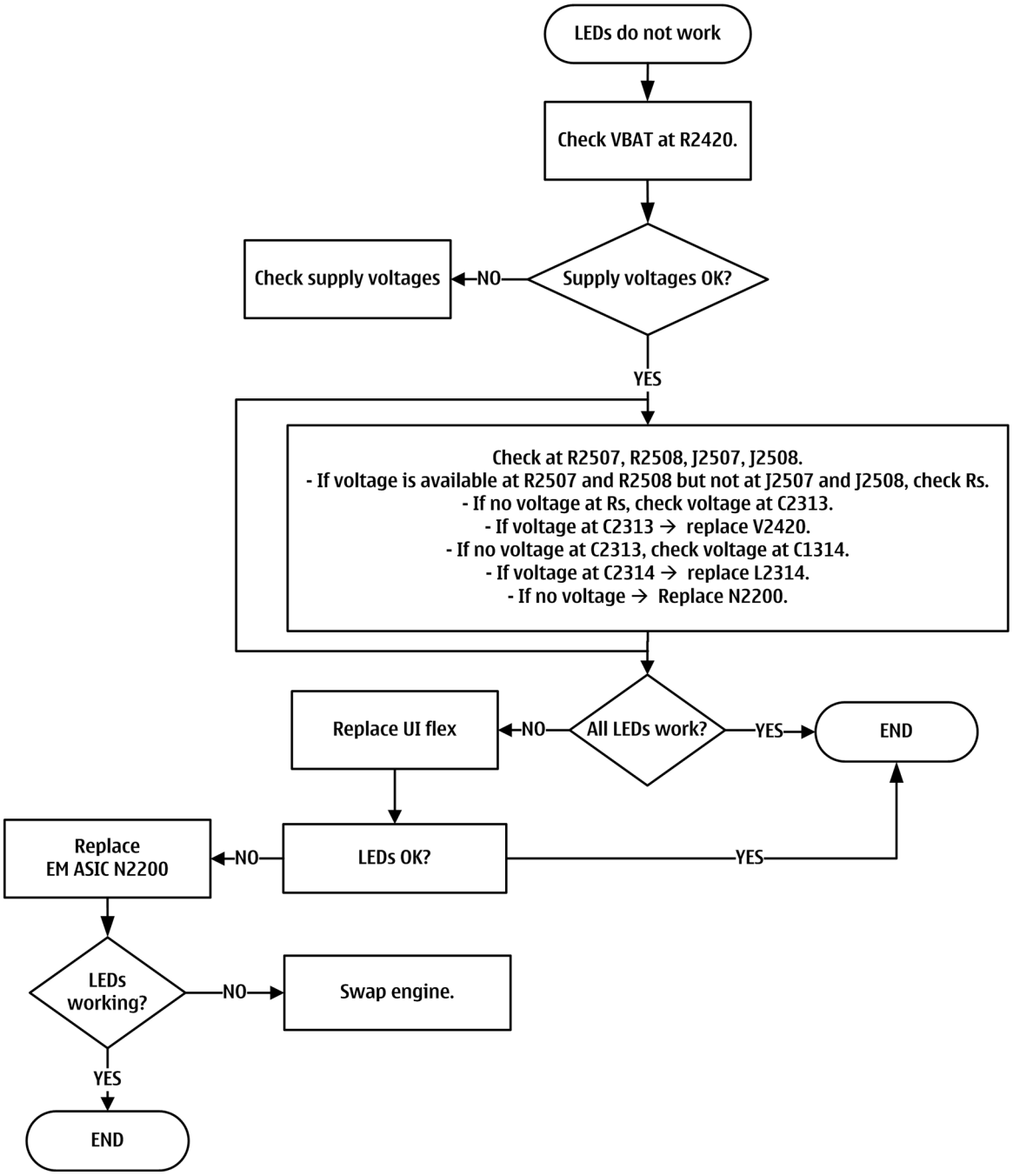
If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow



Keyboard LEDs troubleshooting

Troubleshooting flow



Touch screen troubleshooting

Introduction to touch screen troubleshooting

RM-640/RM–662 has a resistive touch screen user interface and has a traditional ITU-T keypad. The key components of the touch screen user interface are:

- Touch window with touch controller (TSC2004)
- Proximity sensor

The resistive touch window is located above the display. It enables finger as well as stylus touch, and it provides tactile feedback. The tactile feedback is implemented by using the same vibra that is used for alerting. The touch controller includes drivers and the control logic to measure touch pressure.

The proximity sensor is attached to the connector PWB assembly. It sends out a beam of IR light, and then computes the distance to any nearby objects from the characteristics of the returned (reflected) signal. There is a booth between the sensor and the touch window, which isolates the IR transmitter from the IR receiver by preventing the reflection from the touch window surface.

Proximity sensor troubleshooting

Context

Proximity sensor troubleshooting is broken down into two parts. The main purpose of the automatic check is to identify the fault automatically without any manual checks. If the automatic flow does not provide enough information, a manual check can be done to narrow down the cause of the fault.

Troubleshooting flow

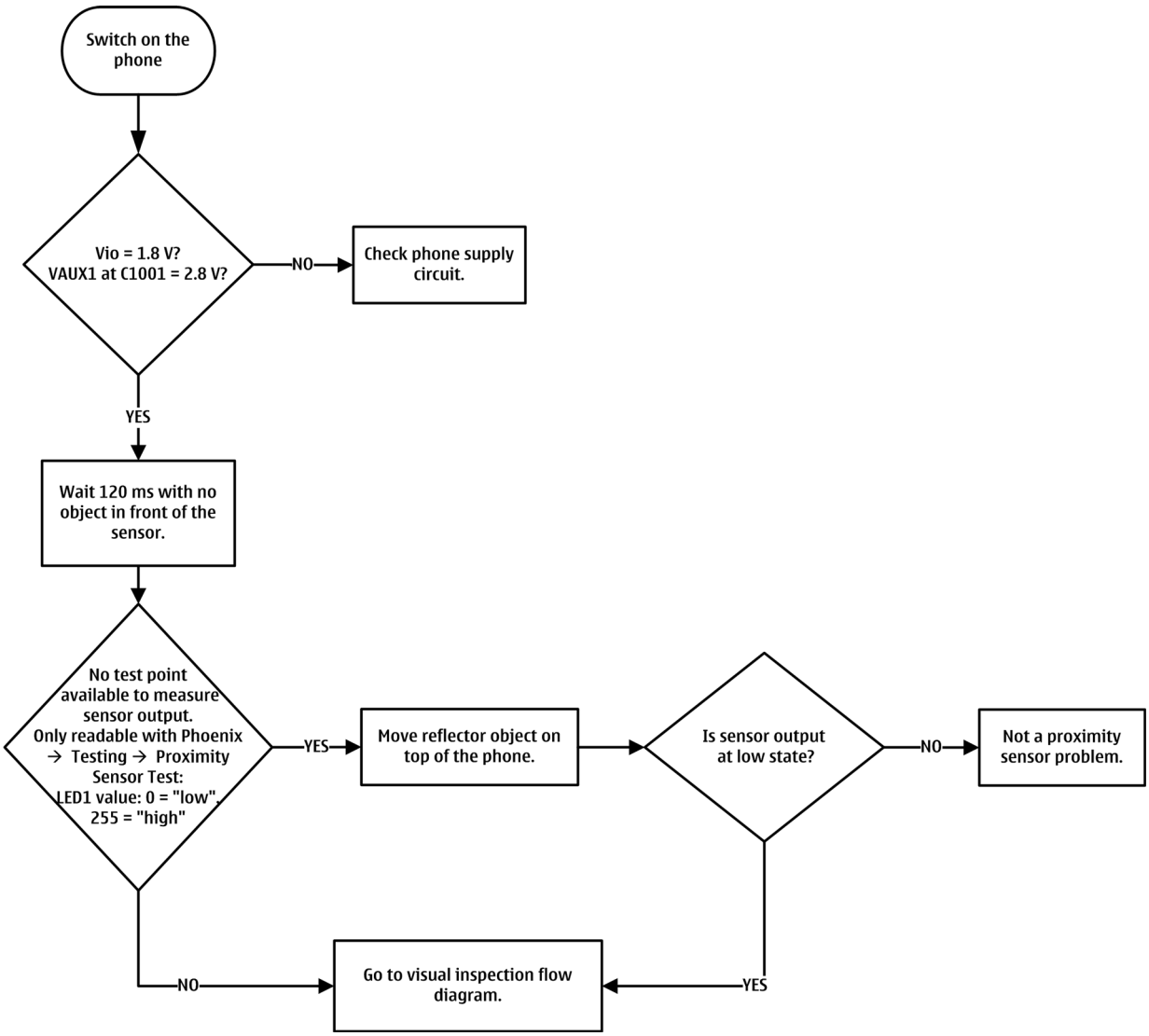


Figure 12 Proximity sensor troubleshooting - part 1

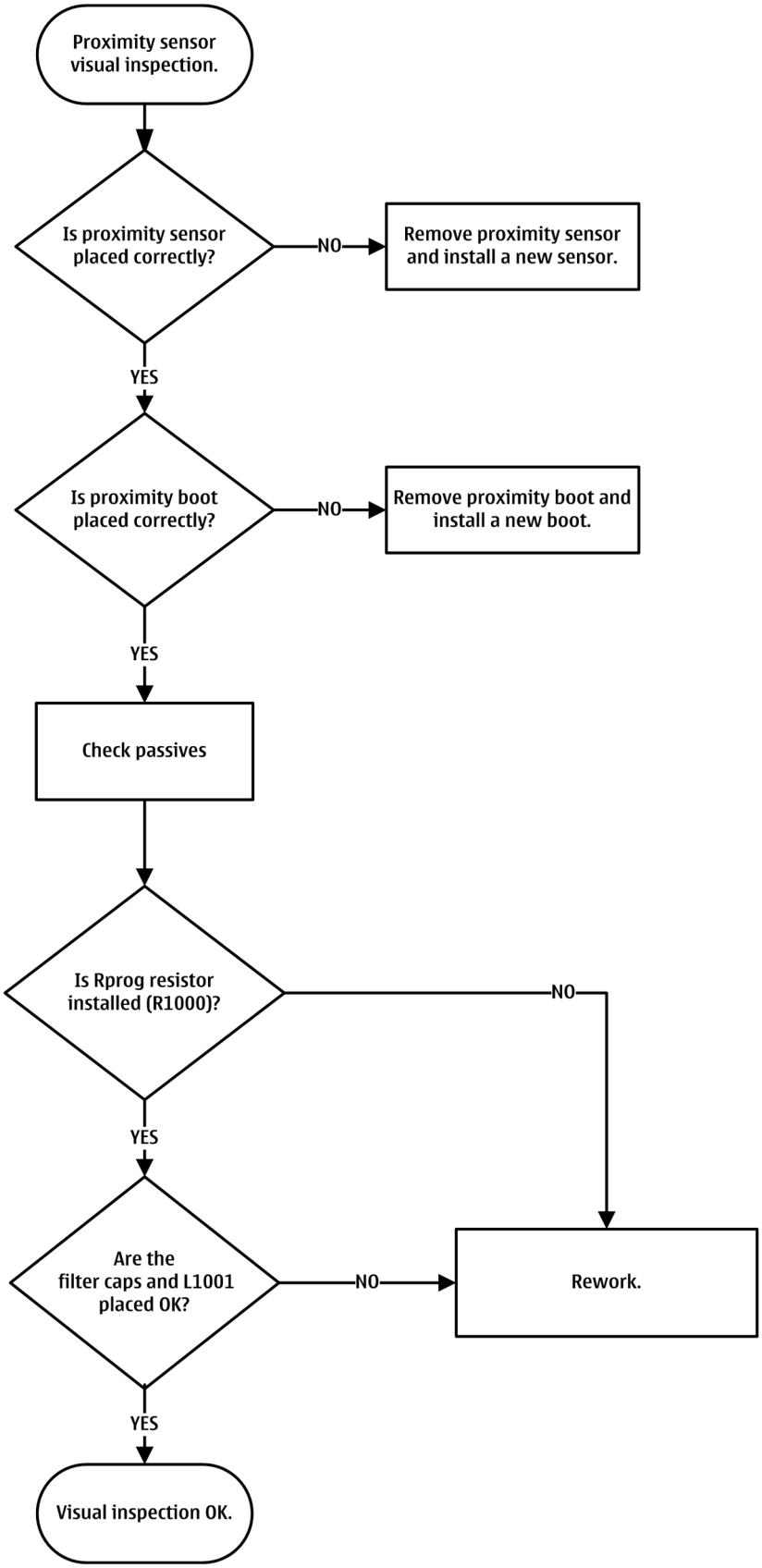


Figure 13 Proximity sensor troubleshooting - part 2

Resistive touch screen troubleshooting

Troubleshooting flow

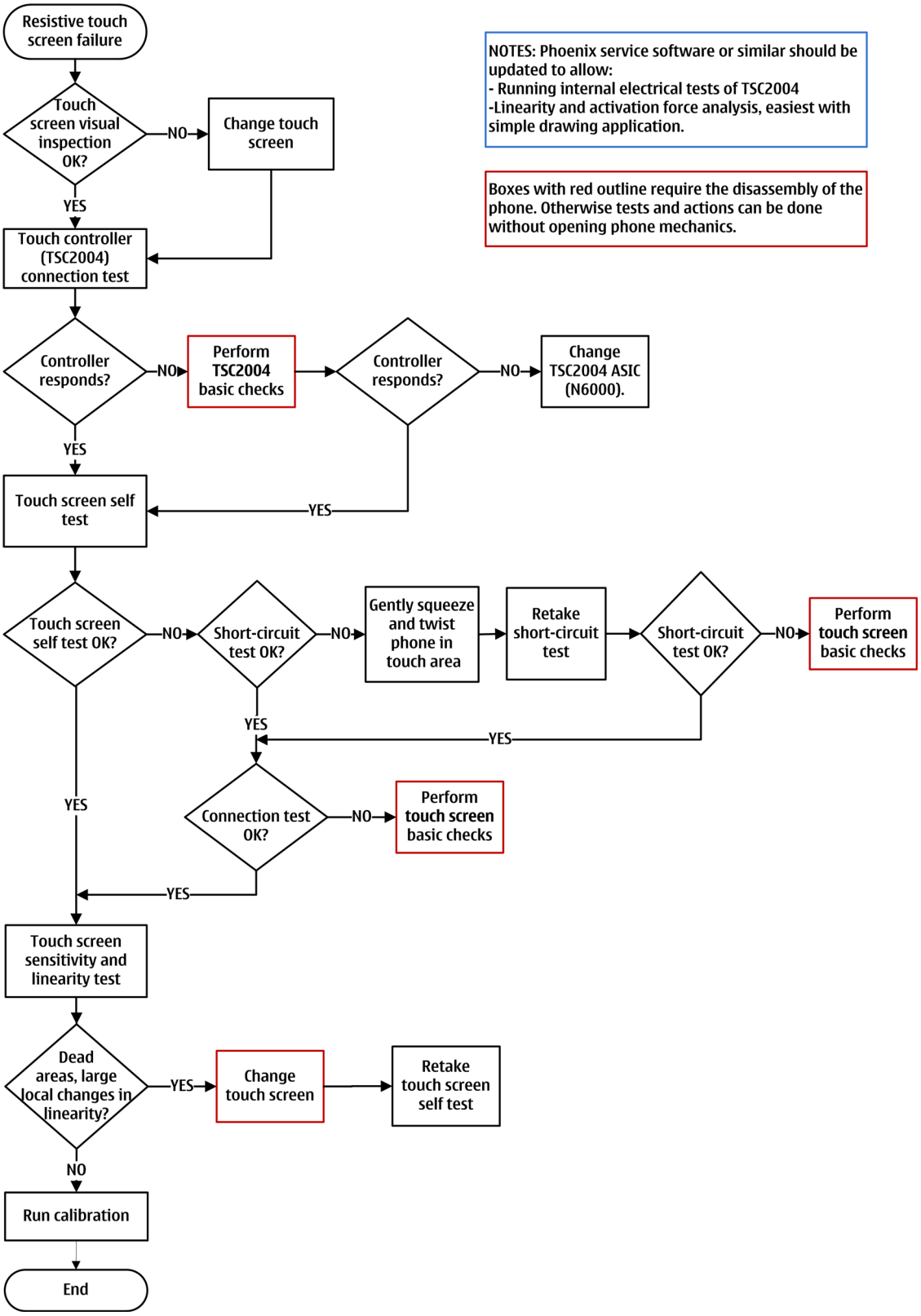


Figure 14 Resistive touch screen troubleshooting

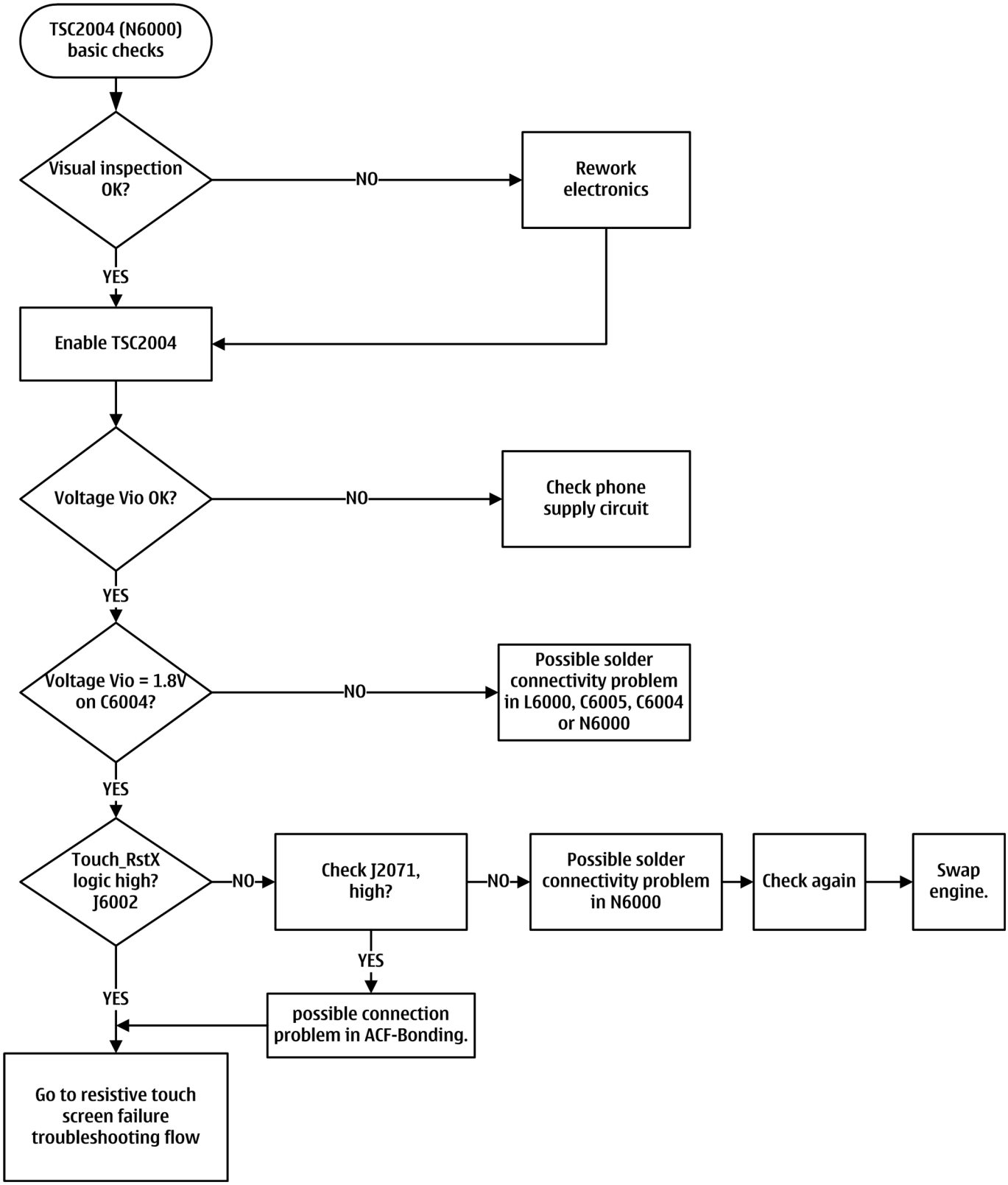


Figure 15 Touch controller basic checks

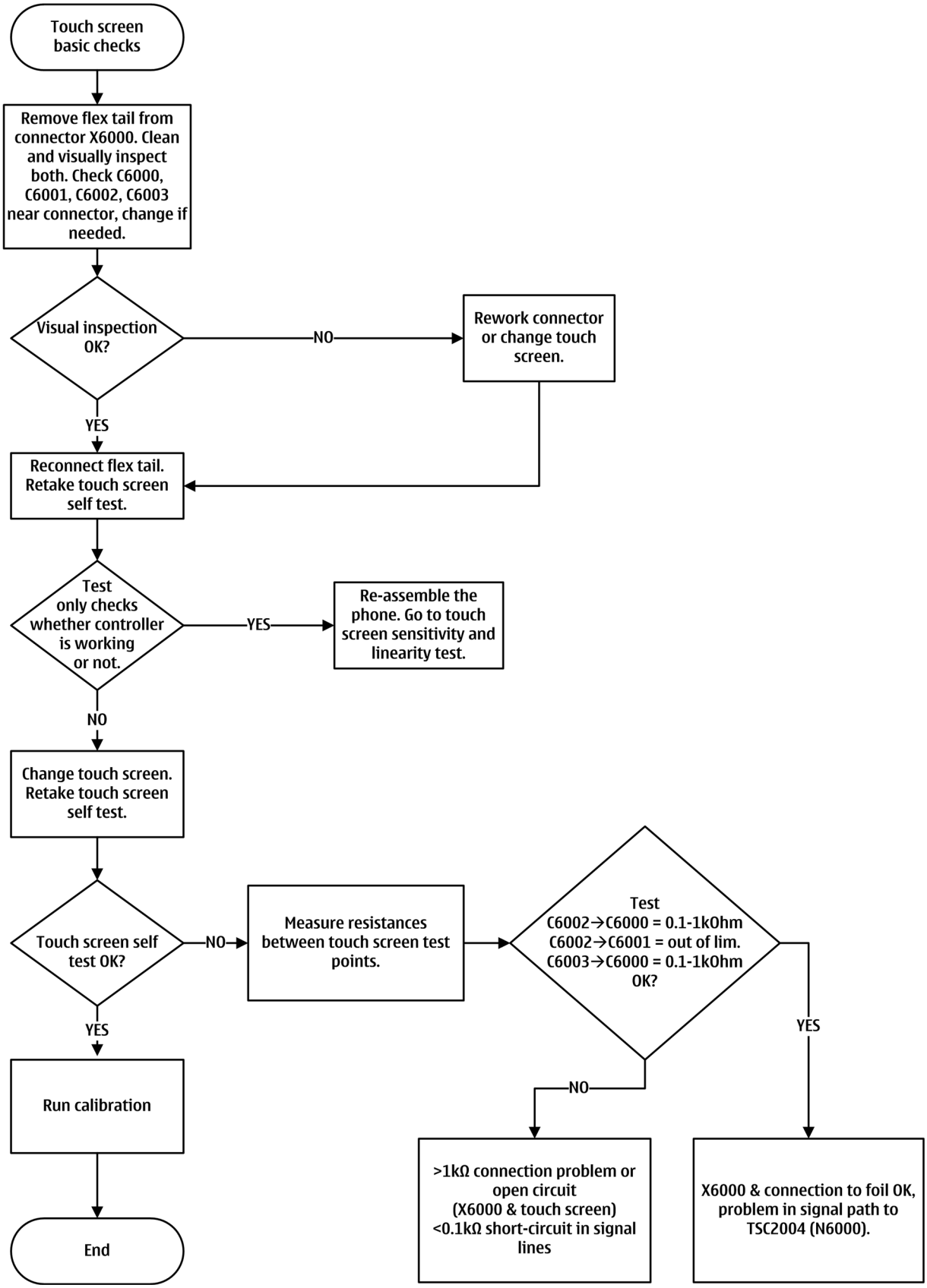


Figure 16 Touch screen basic checks

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 2 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. • If a part of the image is missing, change the display module. • If the image is otherwise corrupted, follow the display fault troubleshooting flowchart.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 3 Pixel defects

<table>
<tr><th>Item</th><th></th><th colspan="4">White dot defect</th><th>Black dot defect</th><th>Total</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defect counts</td><td>R</td><td>G</td><td>B</td><td>White Dot Total</td><td rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>2</td><td>Combined defect counts</td><td colspan="6">Not allowed.
Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.</td></tr>
</table>

Steps

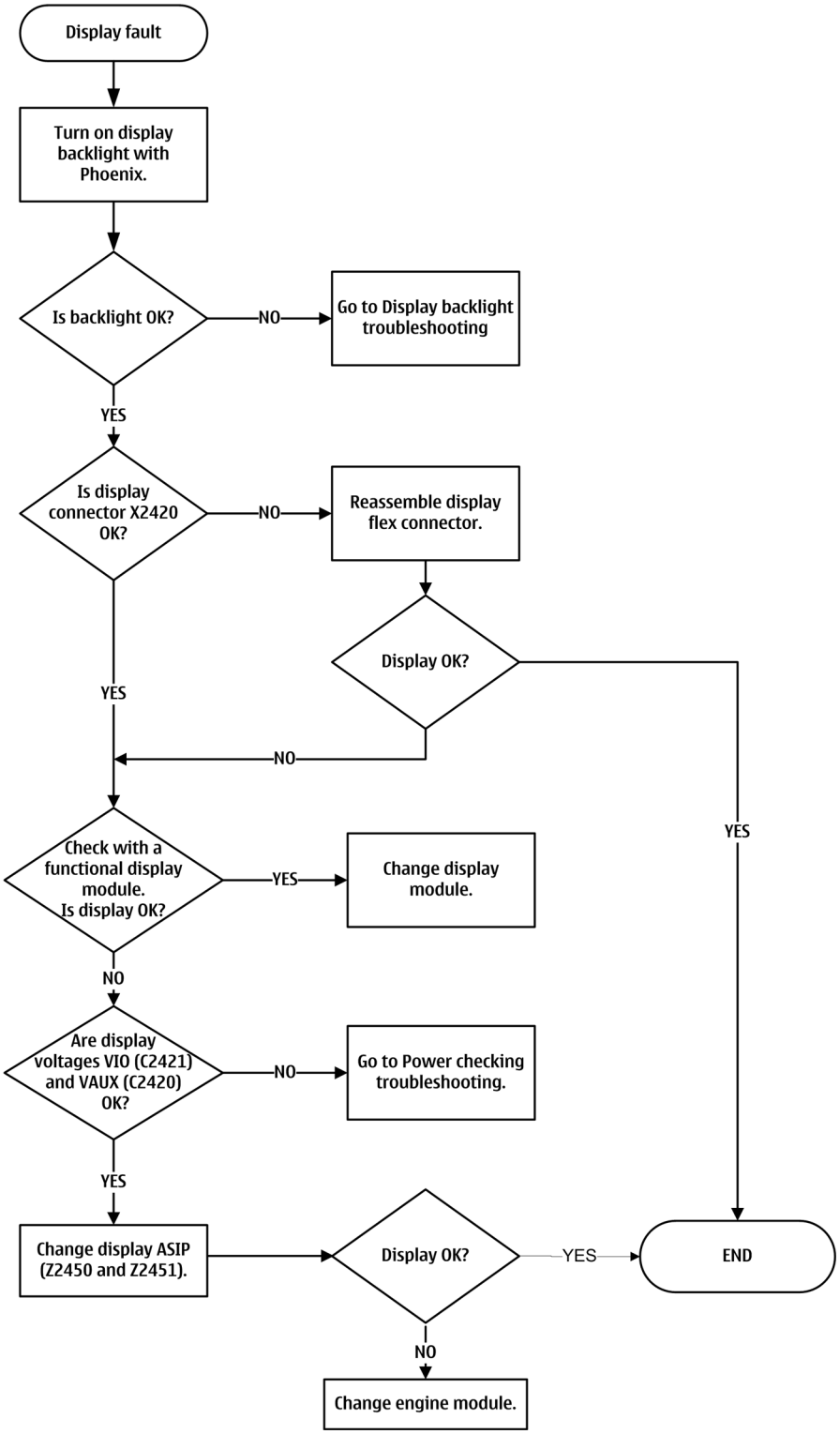
1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display fault troubleshooting flowchart.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

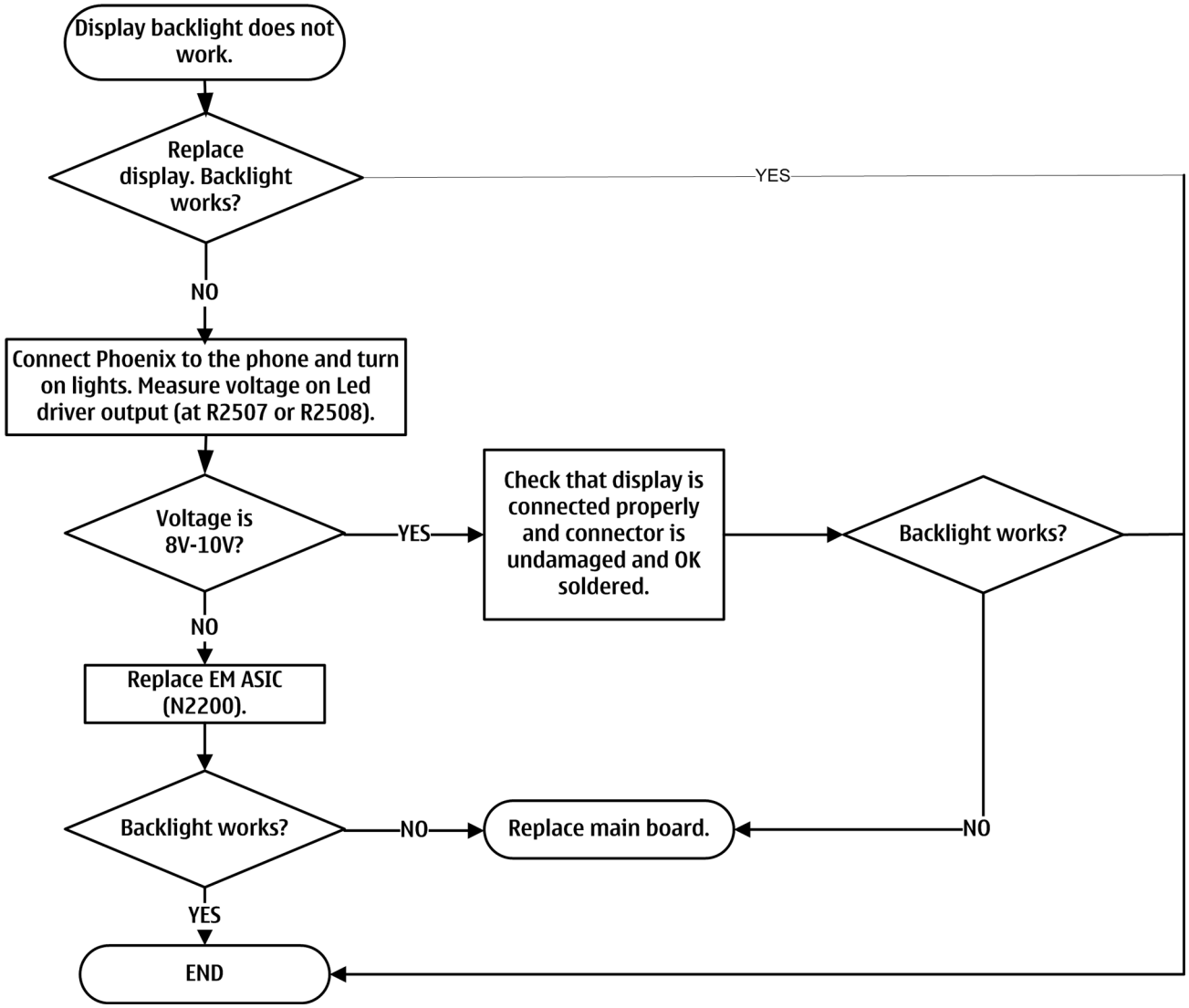
Display fault troubleshooting

Troubleshooting flow



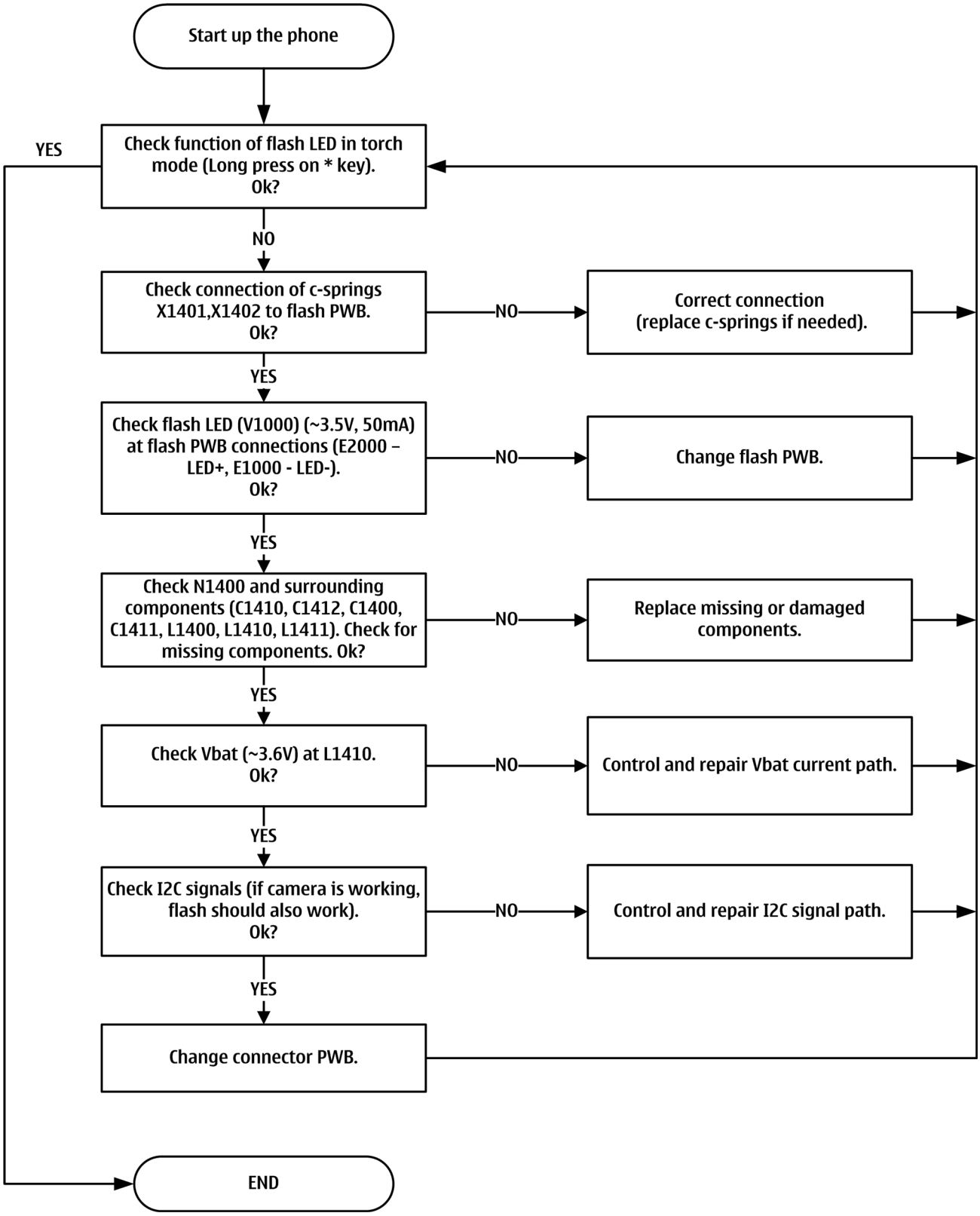
Display backlight troubleshooting

Troubleshooting flow



Flash light troubleshooting

Troubleshooting flow



Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Camera troubleshooting

Taking and evaluating test pictures

When *taking* a test picture, remember the following:

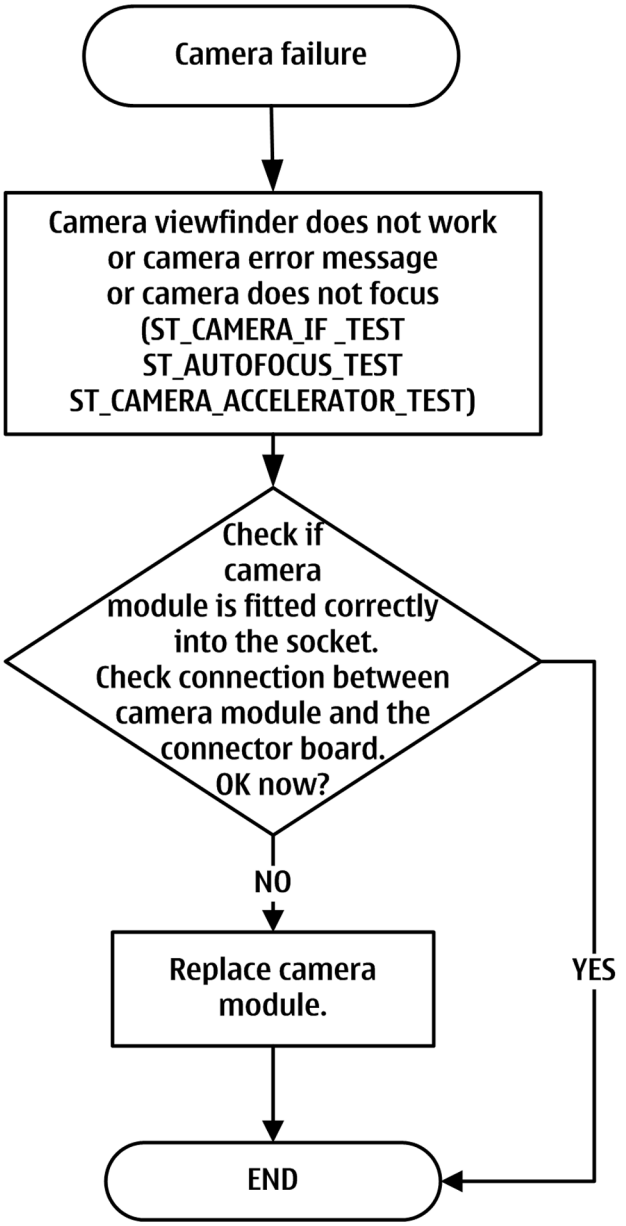
- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)
- Do not take the picture towards a light source
- Hold the phone as still as possible when taking the picture
- If camera has auto focus: Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device
- If camera has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!

Camera troubleshooting

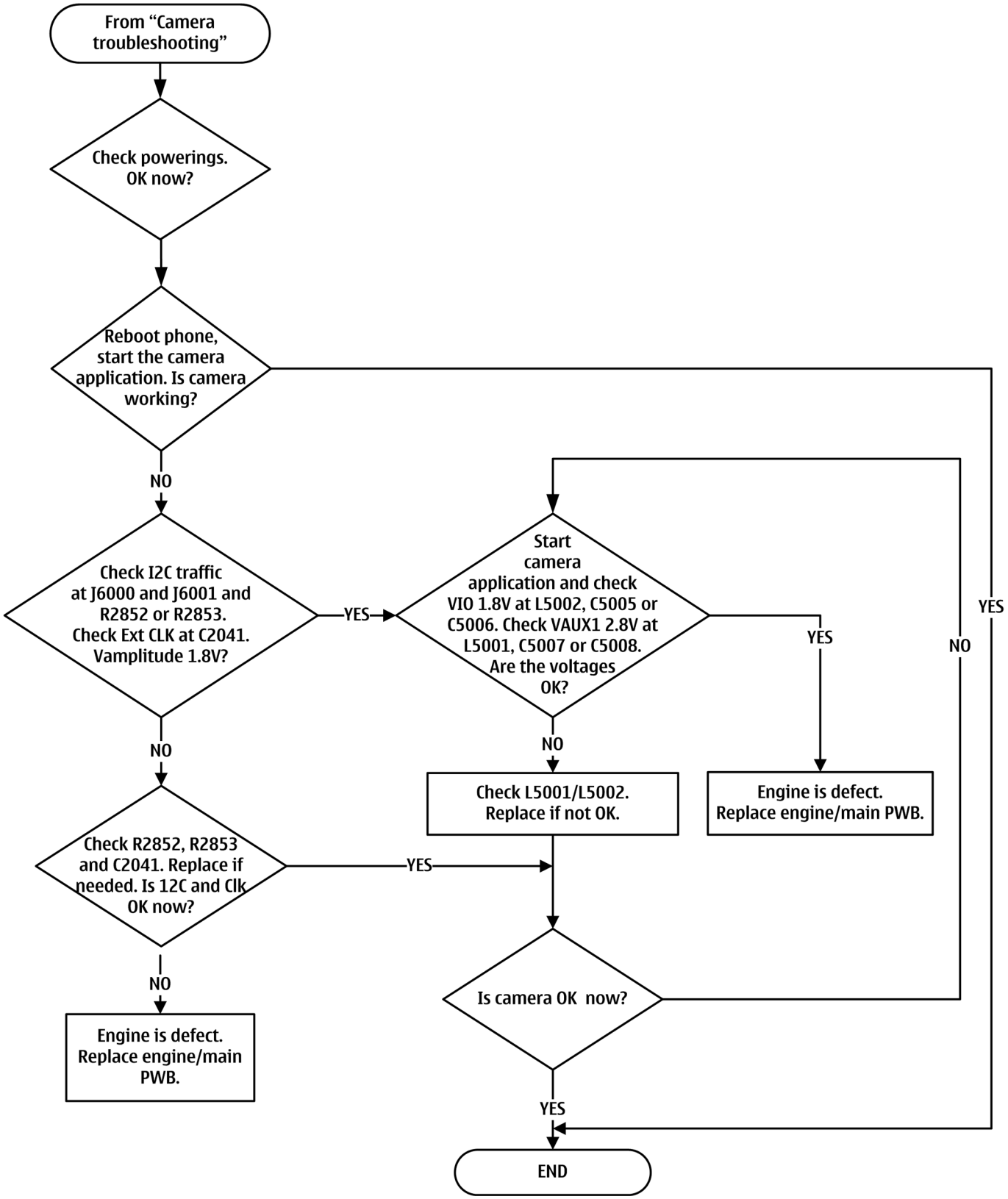
Troubleshooting flow



Note:
The message “Camera on standby” at camera application startup can indicate that there is a failure.

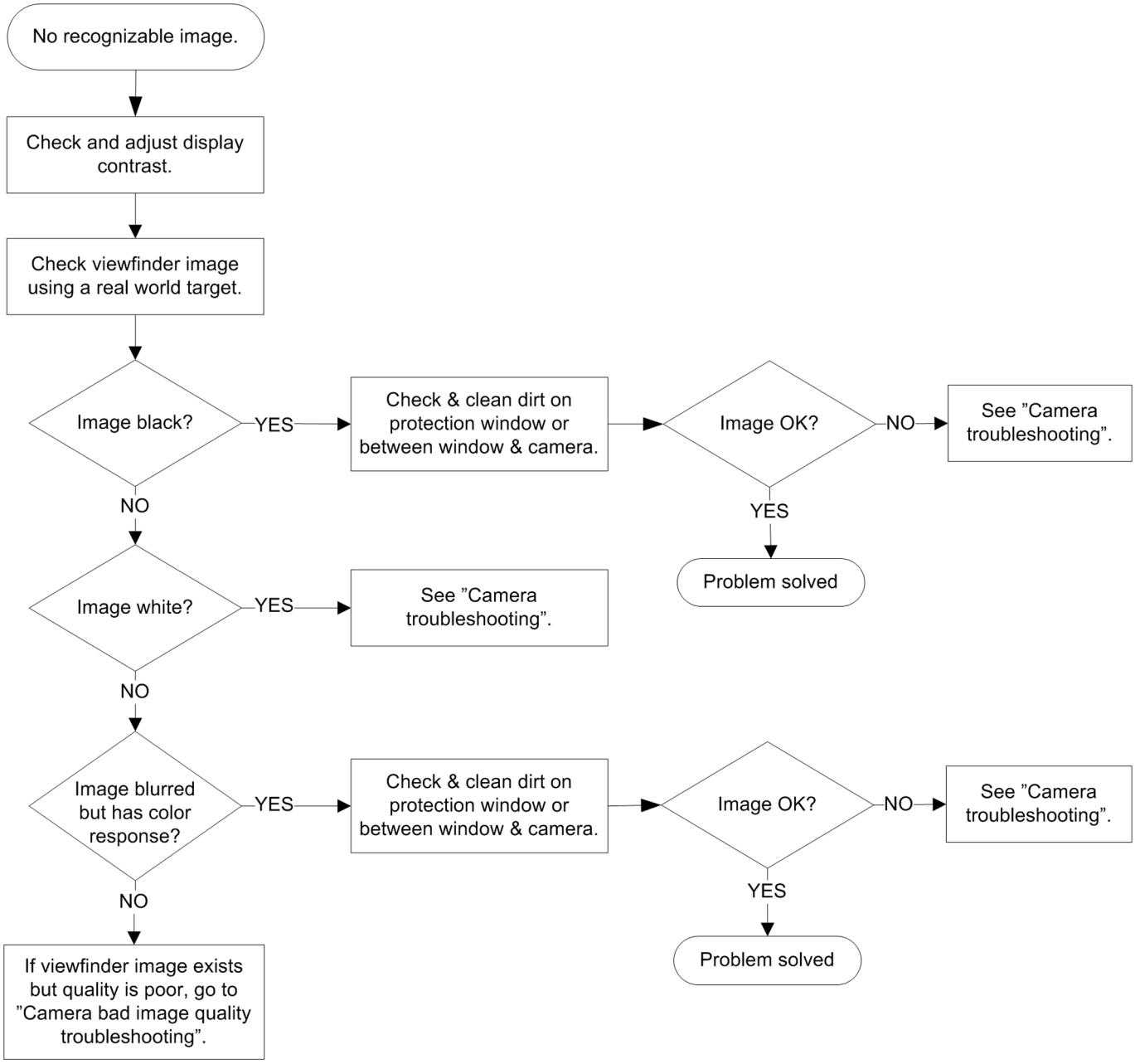
Camera baseband troubleshooting

Troubleshooting flow



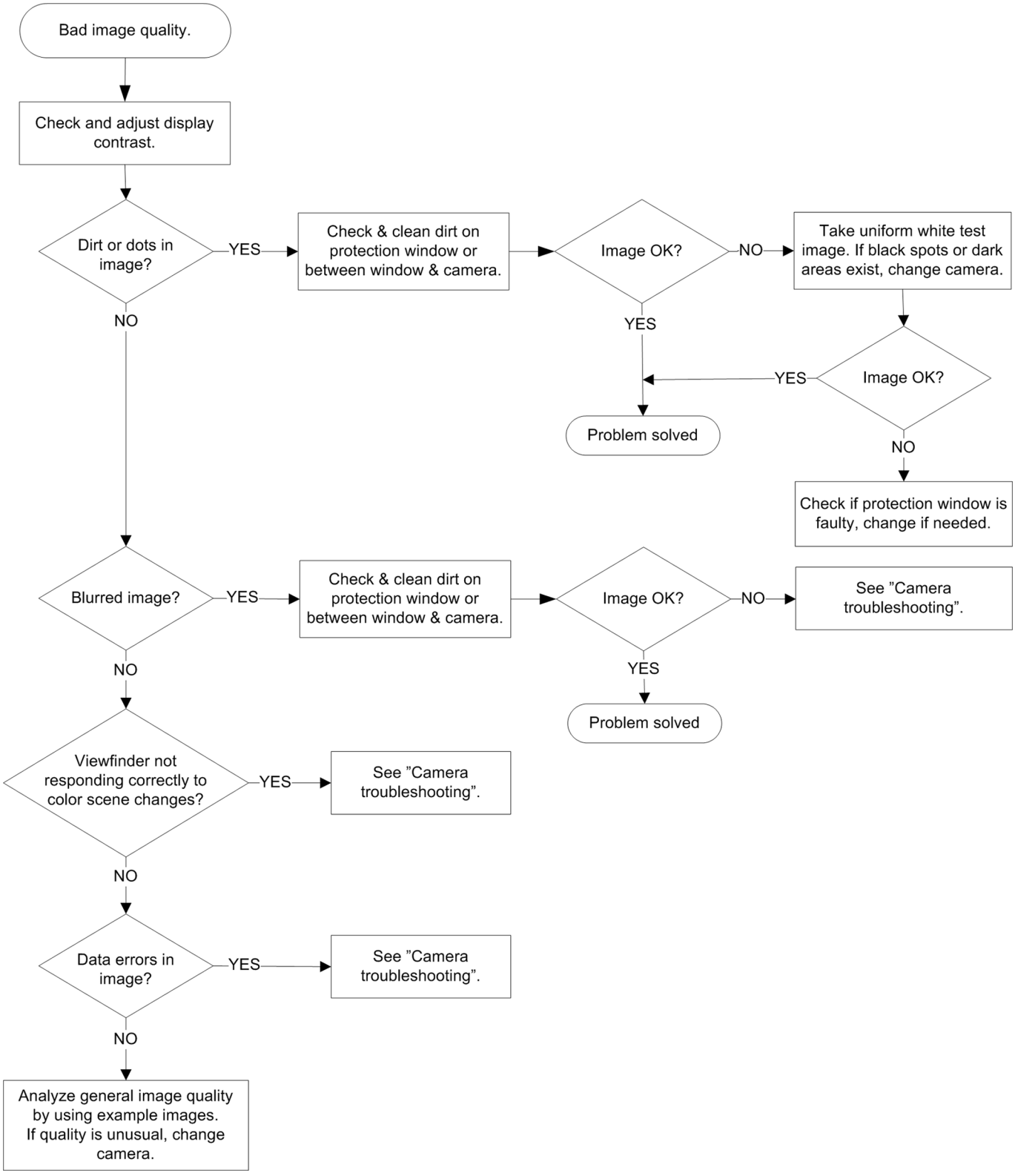
Camera no recognizable viewfinder image troubleshooting

Troubleshooting flow



Camera bad image quality troubleshooting

Troubleshooting flow



Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. These different audio loop paths can be activated:

- Mic2P to Internal earpiece
- Mic2P microphone to Internal handsfree speaker

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in a table in the following section.

Phoenix audio loop tests and test results

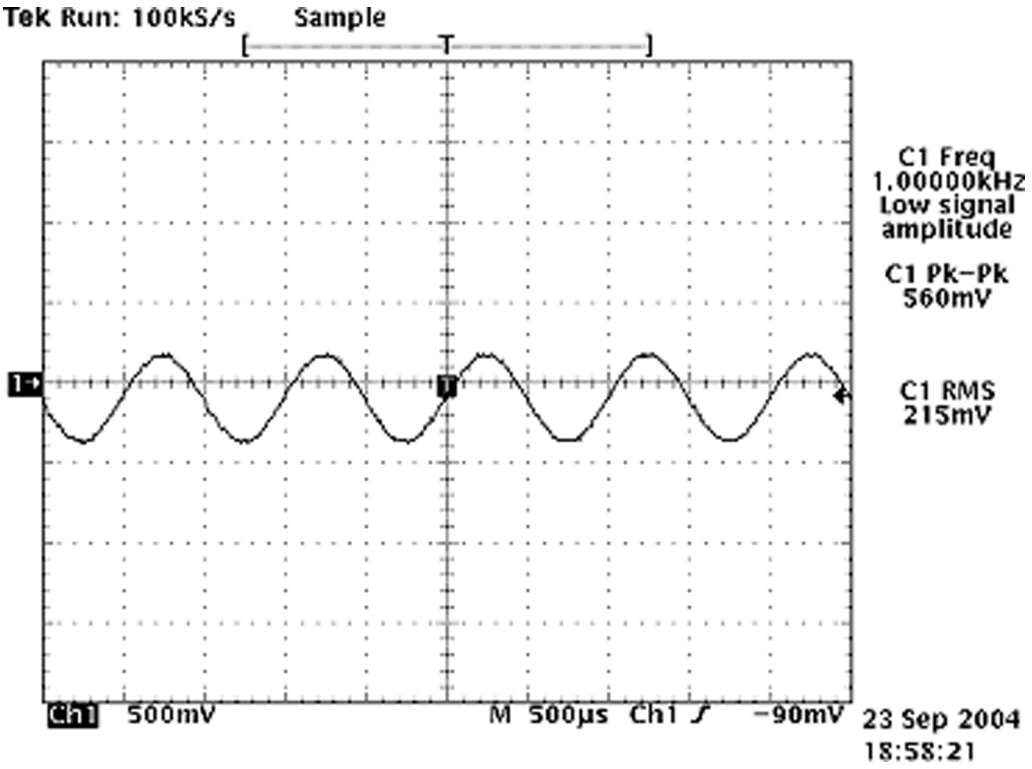
The results presented in this table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]	
External Mic to Internal Earpiece	C2033	E2050 (EARP) / E2051 (EARN)	~9	100	288	NA	NA	
External Mic to Internal handsfree	C2033	X2100// X2101	~16	100	600	NA	NA	

Measurement data

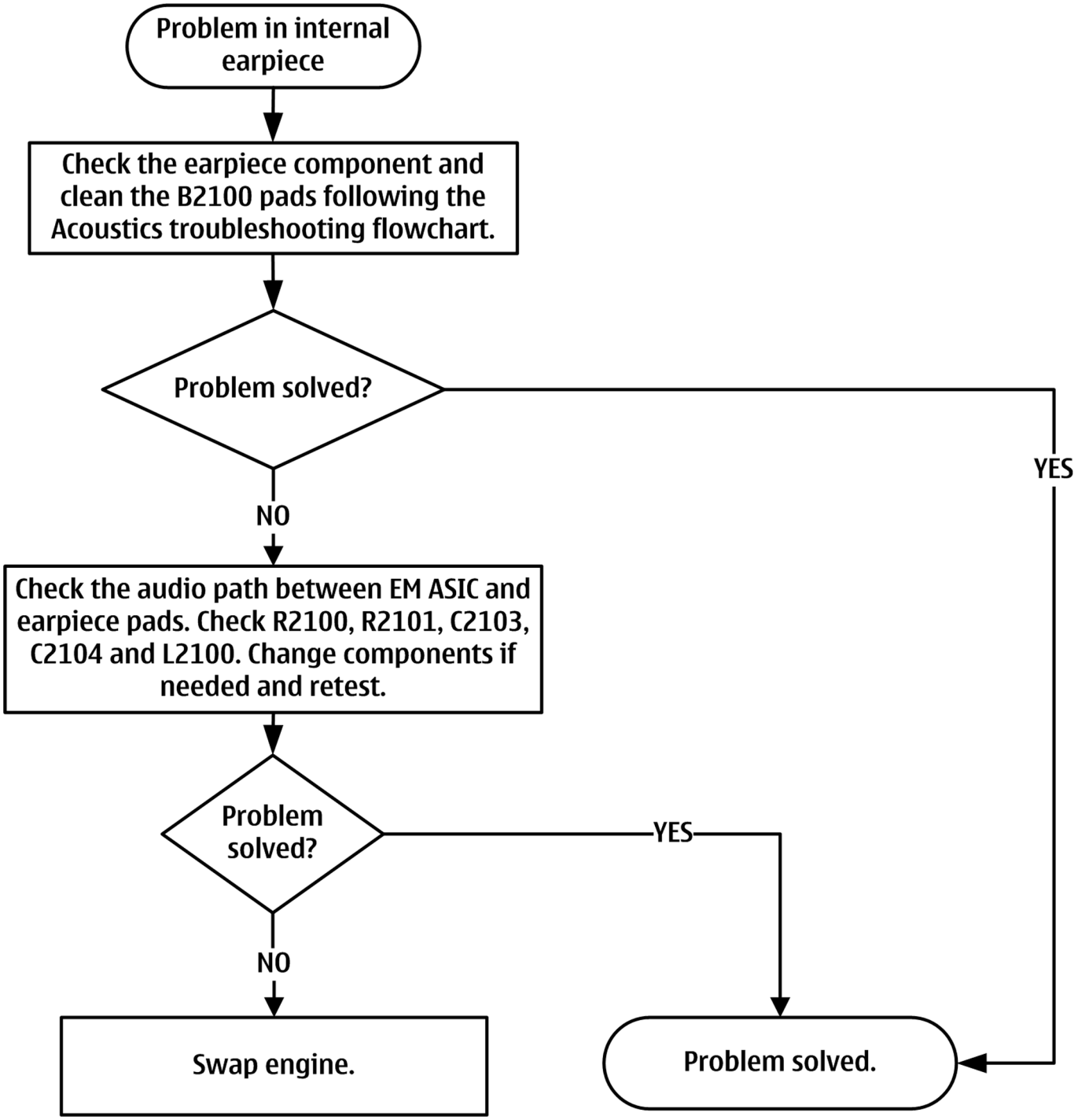


If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 17 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

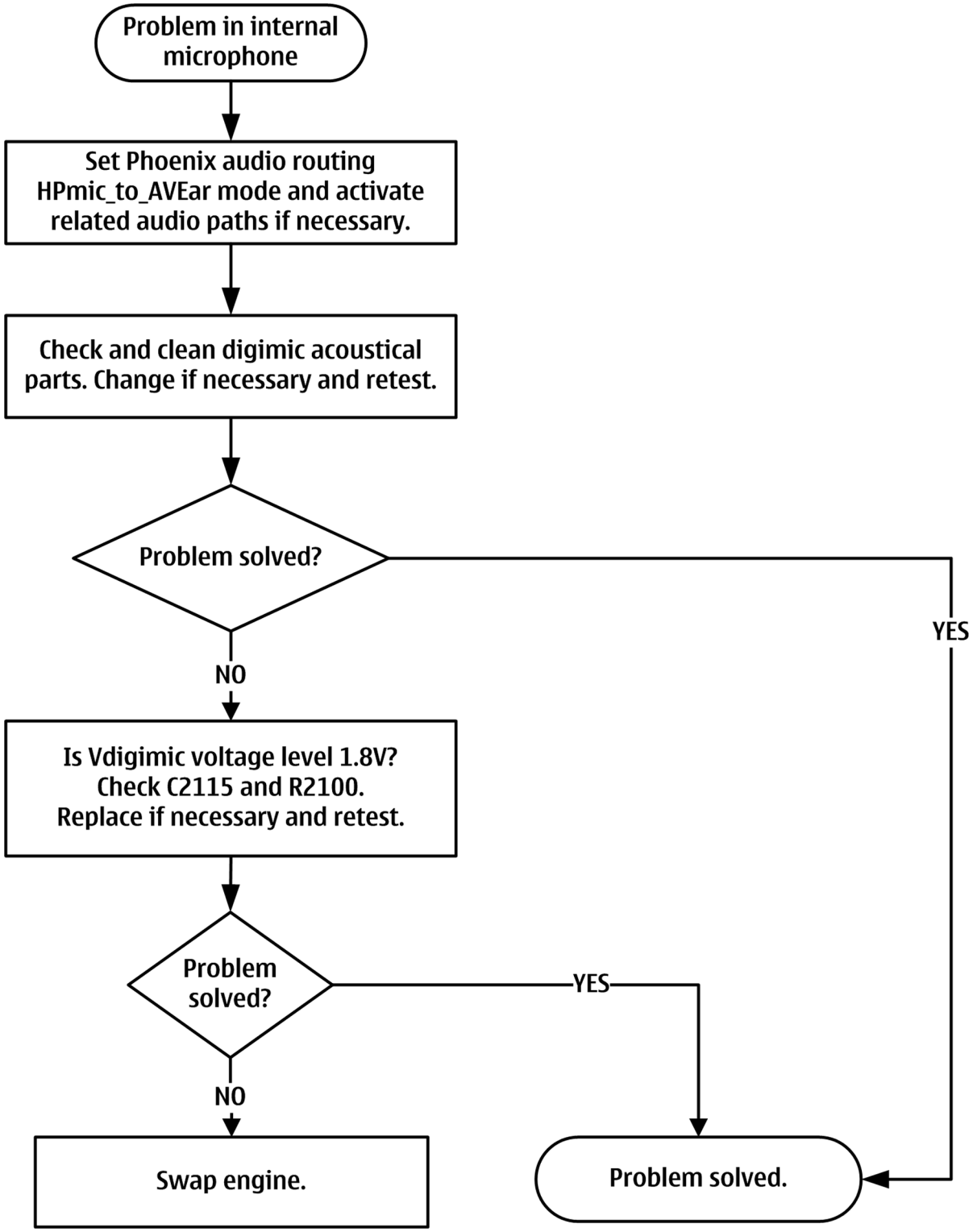
Internal earpiece troubleshooting

Troubleshooting flow



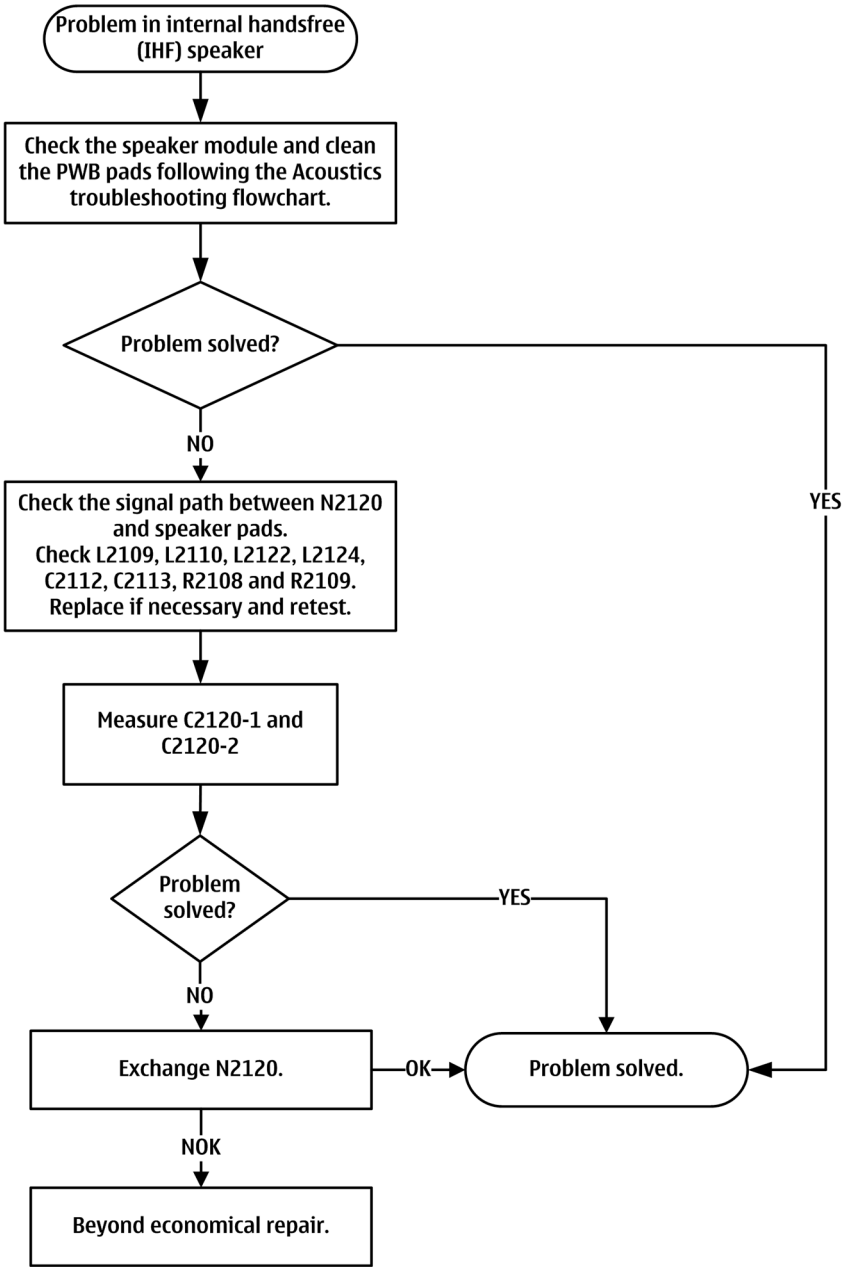
Internal microphone troubleshooting

Troubleshooting flow



Internal handsfree (IHF) troubleshooting

Troubleshooting flow



Acoustics troubleshooting

Introduction to acoustics troubleshooting

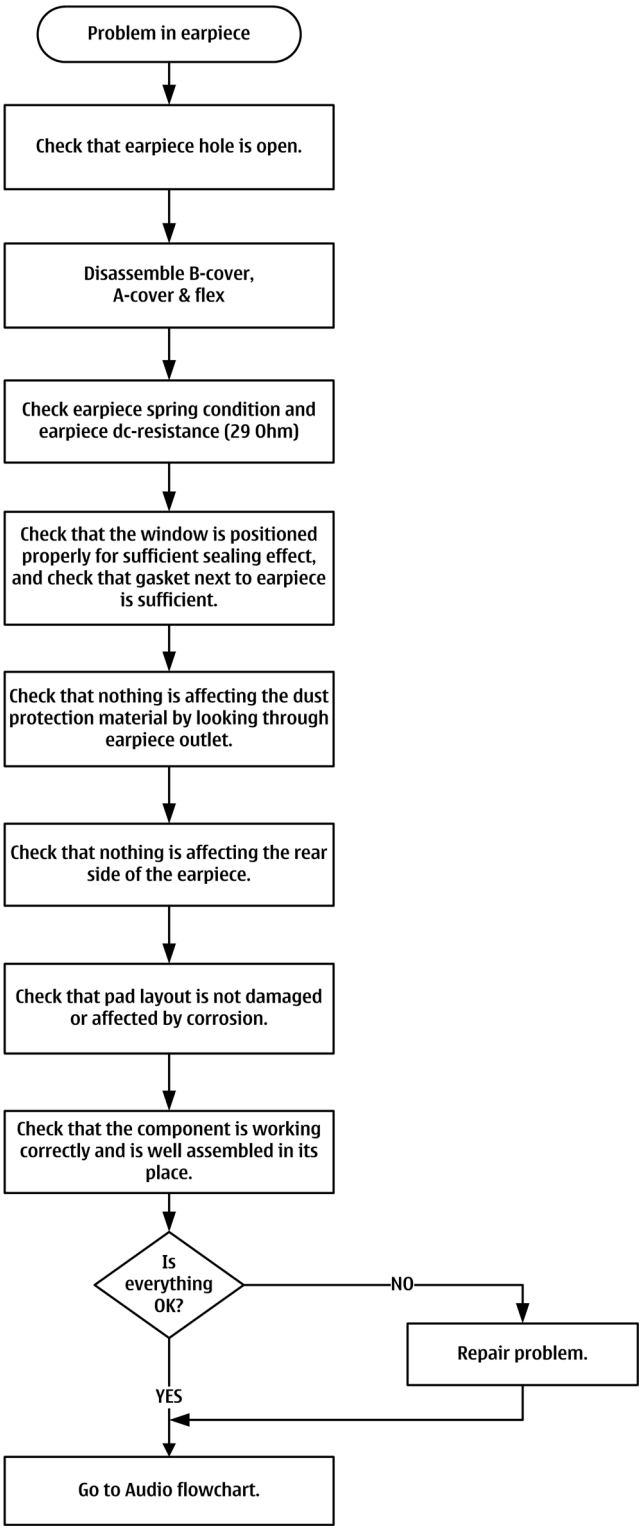
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone include three basic systems: earpiece, integrated handsfree (IHF) and microphone.

The sound reproduced from the earpiece eradiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from the sound hole located on the backside on the bottom part of the phone. The inlet for the microphone can be found in the keymat area.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

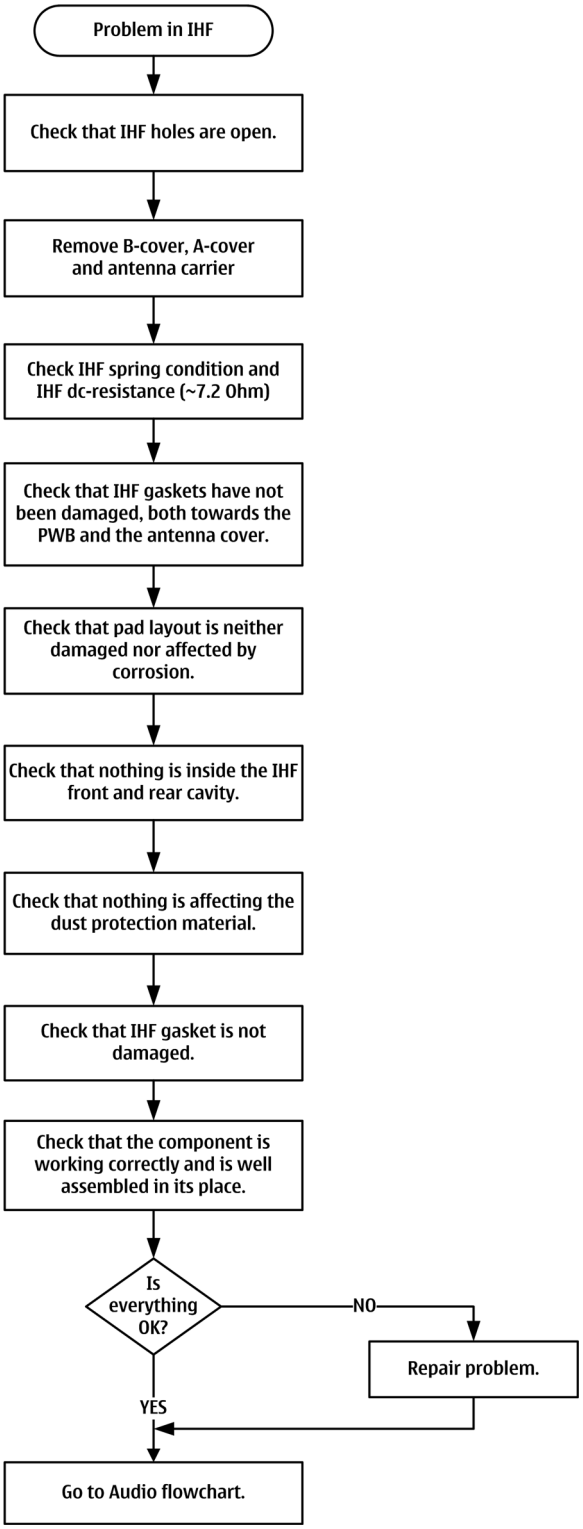
Earpiece troubleshooting

Troubleshooting flow



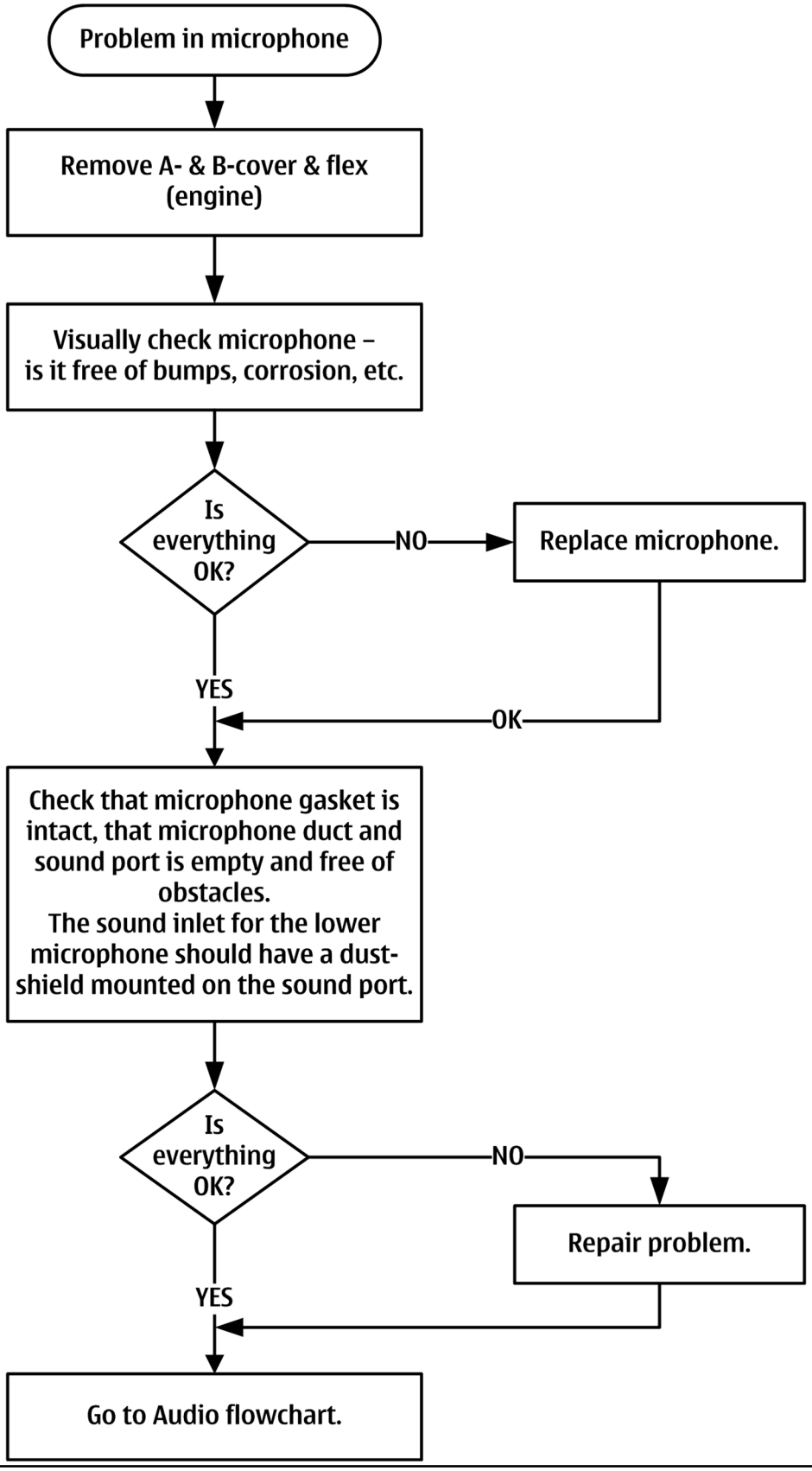
IHF troubleshooting

Troubleshooting flow



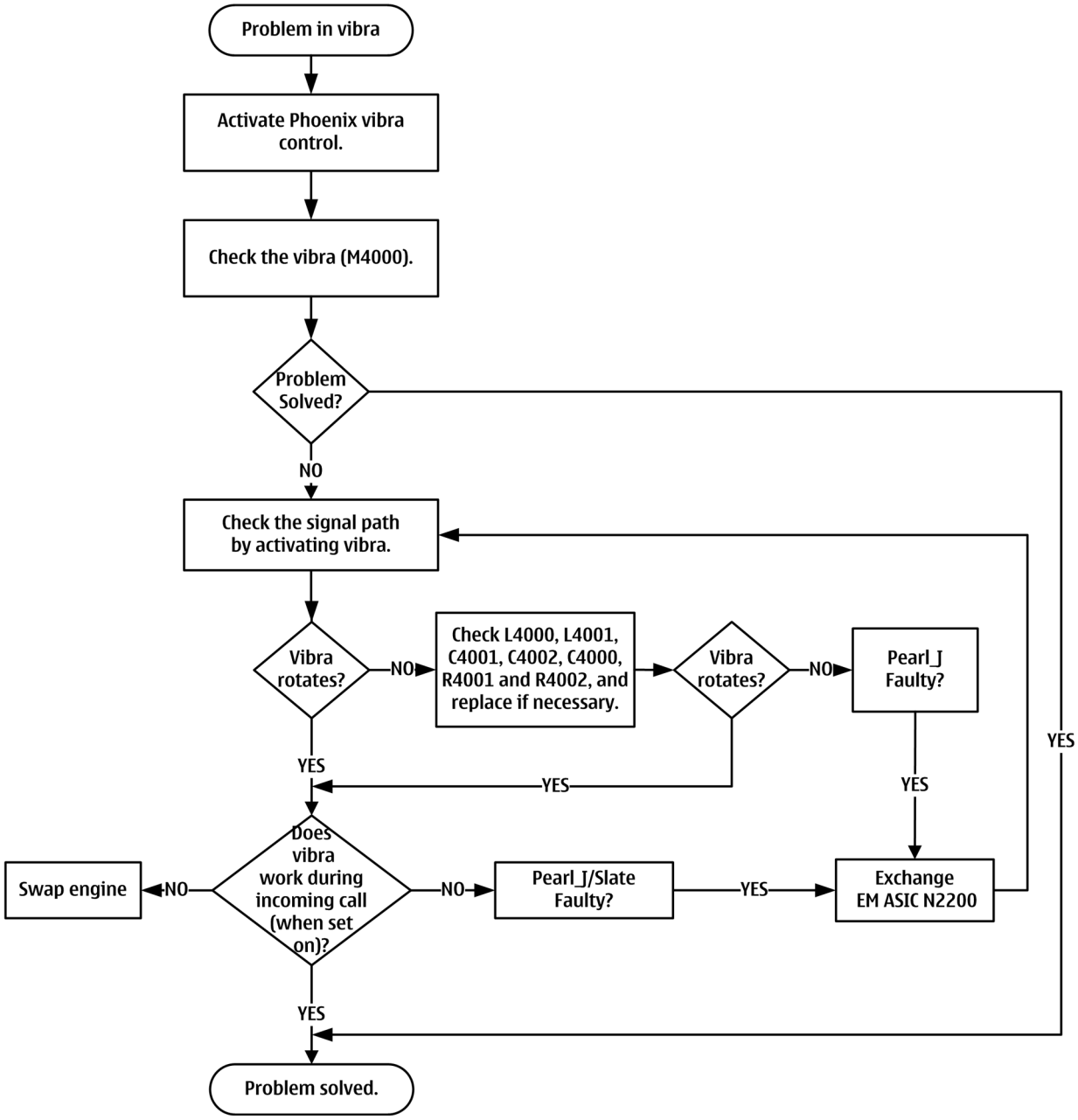
Microphone troubleshooting

Troubleshooting flow



Vibra troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-20 or FPS-21.

Note: USB flashing does not work for a dead BB5 phone.

- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

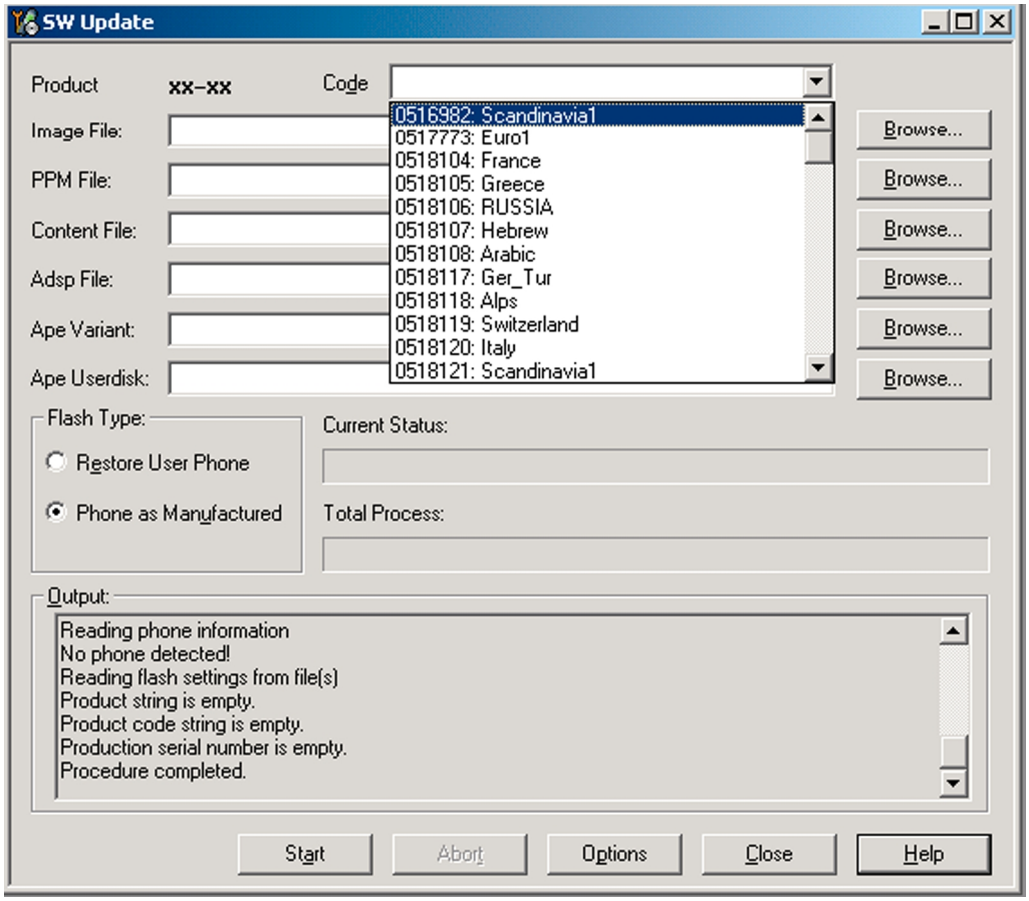
Required equipment and setup:

- *Phoenix* service software v 2008.34/38 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- Activated FPS-20 flash prommer **OR** FPS-21 flash prommer
- Flash update package 08.30.012 or newer for FPS-20 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

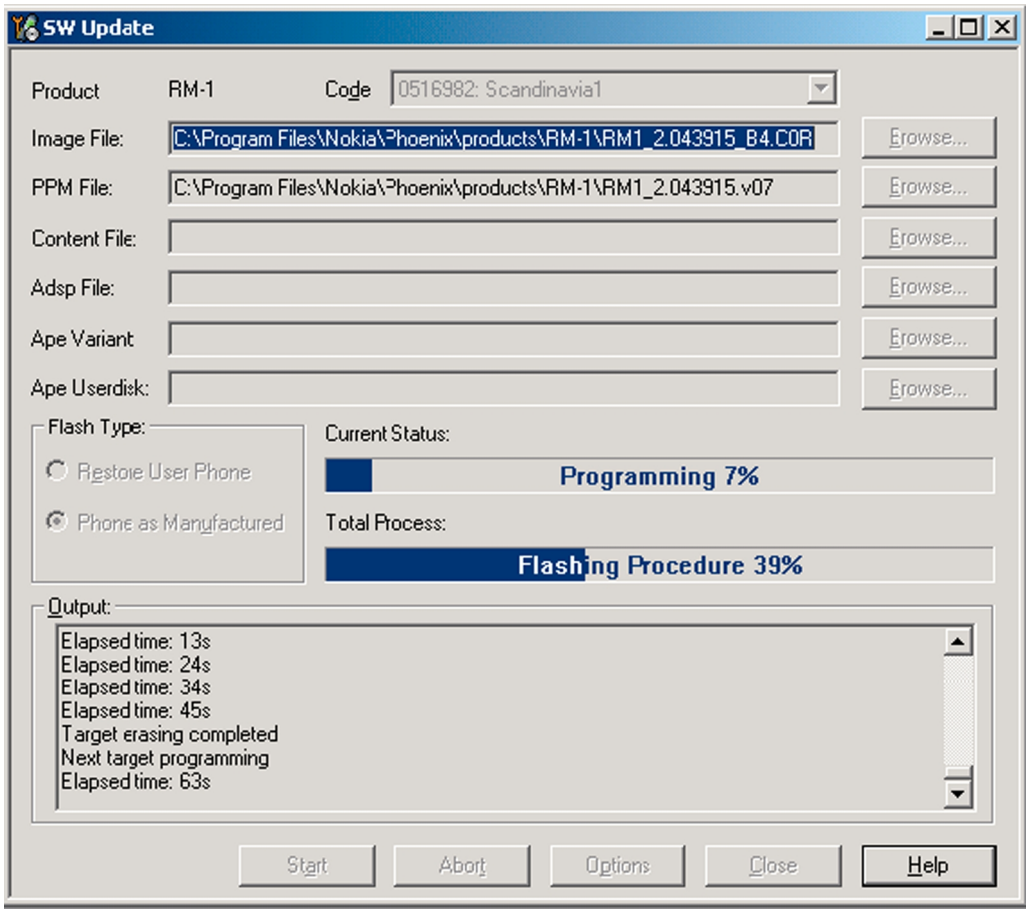
1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-20 or FPS-21.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   iii Choose the product manually from **File** → **Open Product** , and click **OK**.
   Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   iv Go to **Flashing** → **SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.



Programming is completed when Flashing Completed message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File → Close Product** .

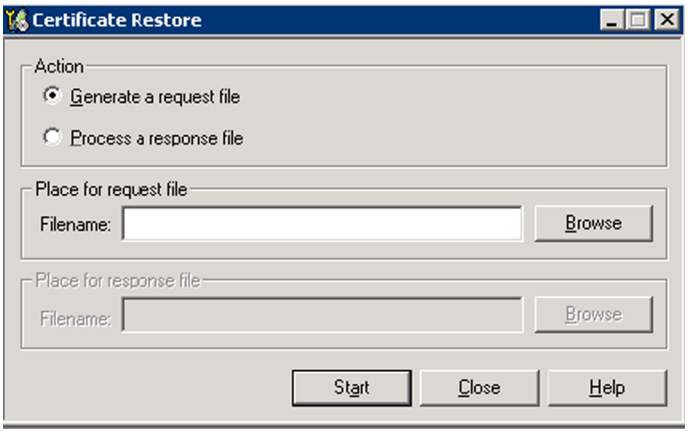
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

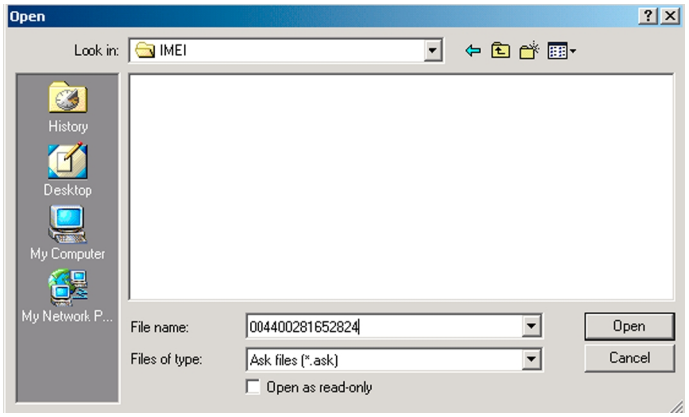
i To connect the phone with *Phoenix*, choose **File → Scan Product** .

ii Choose **Tools → Certificate Restore** .

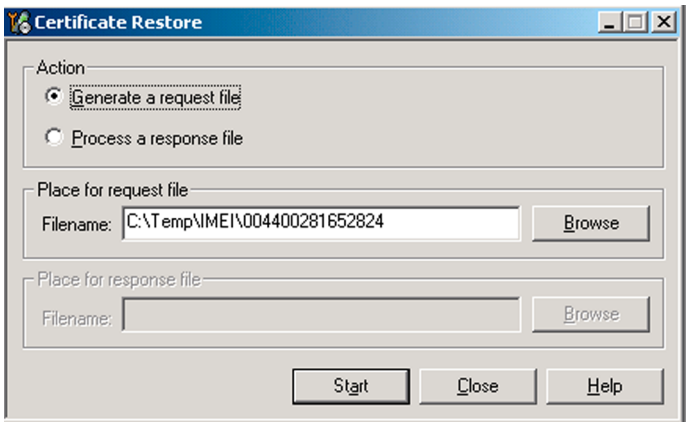
iii To choose a location for the request file, click **Browse**.



iv Name the file so that you can easily identify it, and click **Open**.



The name of the file and its location are shown.



v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

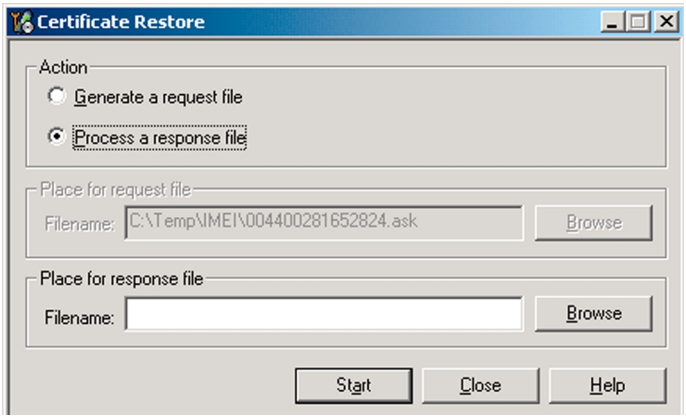
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

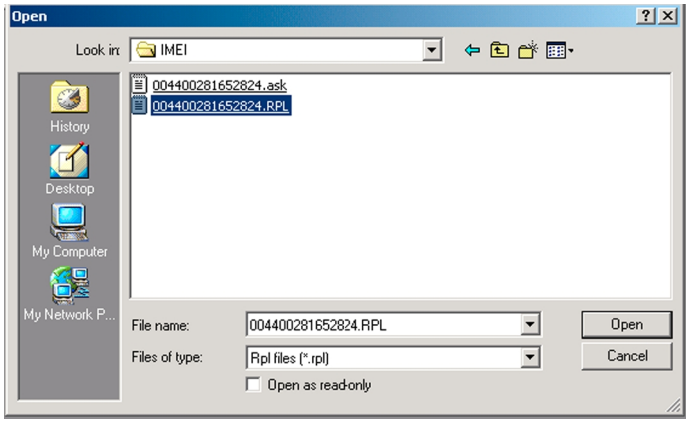
iii Choose **File** → **Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



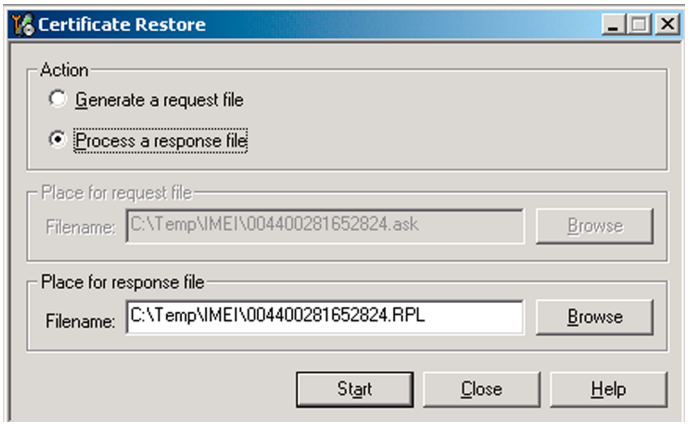
v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product.**
4. Choose **Tuning** → **Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 4 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-14	+14
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2450	2800
VBAT Gain	15000	21900
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250
VBATVANAGAIN	33000	37000
VBATVANAOFFSET	-100	+100

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — Cellular RF troubleshooting

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Table of Contents

List of Figures

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General instructions for cellular RF troubleshooting

Most RF semiconductors are static sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10 Mohm//8 pF.
- Willtek 440x/3100, Rohde & Schwarz CMU-200 or CMW-500 radio communication tester.

Note: A mobile phone WCDMA transmitter should never be tested with full TX power (permitted only if measurements and tests are performed in an RF-shielded environment). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular communication in a wide area.

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use an RF-shielded environment, testing at frequencies of nearby base stations should be avoided.

Note: All communication test set screen dumps are from CMU-200. Other testers are different.

RF auto tune

Cellular RF parameters should always be re-tuned by means of Testing and Tuning Tool if one or more of the RF components have been changed or memory (D3000) is corrupted.

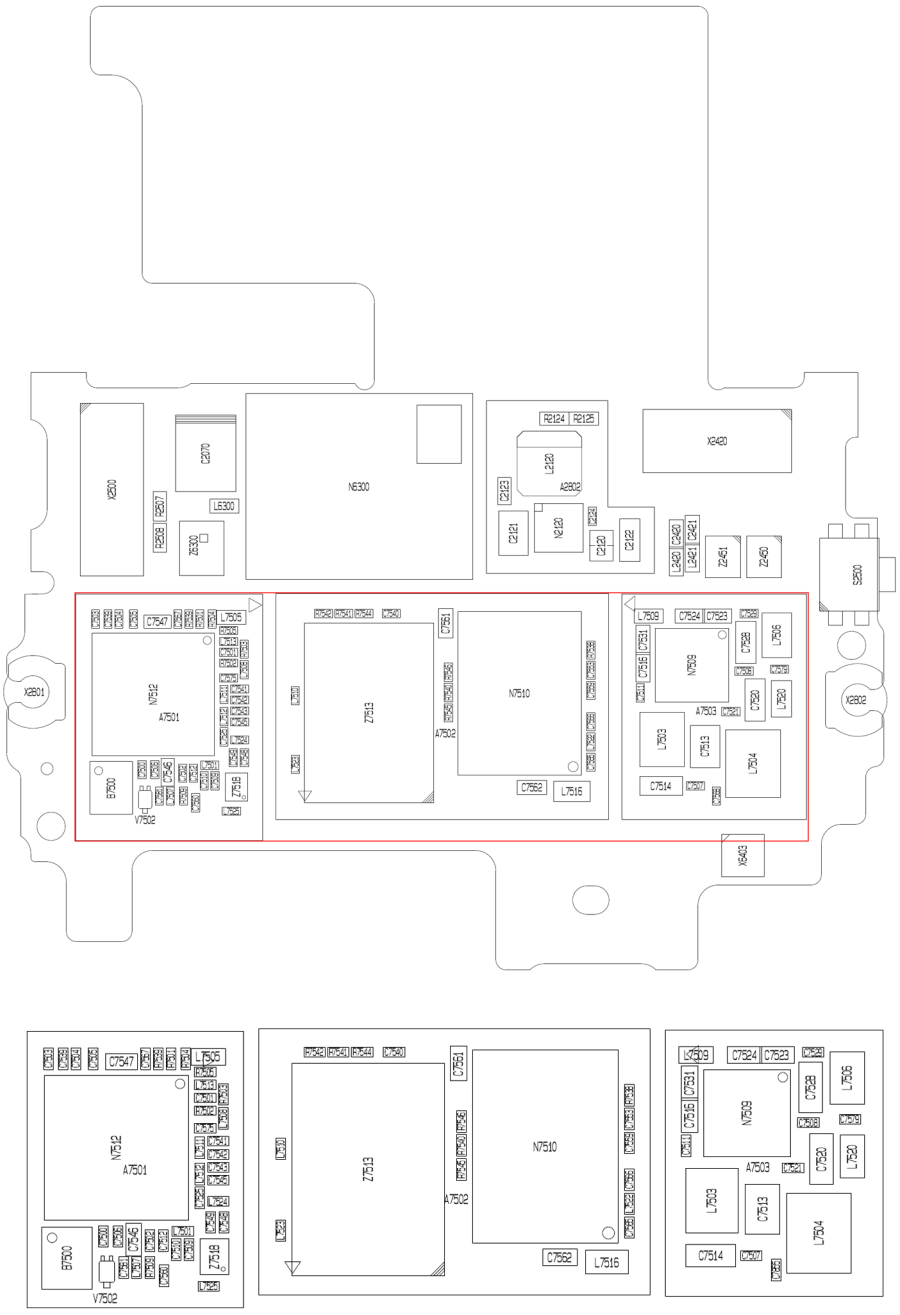
RF shield cans

Once a peel-off type RF shield can is opened, a repair lid (Nokia code 9501325) should always be installed. RF shielding does not work at all if RF shield cans are left open.

Level of repair

The scope of this guideline is to verify functionality of the cellular RF block as well as possible without removing RF shields.

Cellular RF key components



Linko RF has the following key components:

- Älli N7512 (Transceiver RF ASIC)
- Aura N7509 (RF power management ASIC)
- UKKO N7510 (Power amplifier, PA)
- QuBBE Z7513 (Front end module)

Linko RF has separate RF shielding cans for:

- Älli N7512 + surroundings (Shield C)
- QuBBE Z7513 + Ukko PA N7510 (Shield B)

- Aura N7509 + surroundings (Shield A)

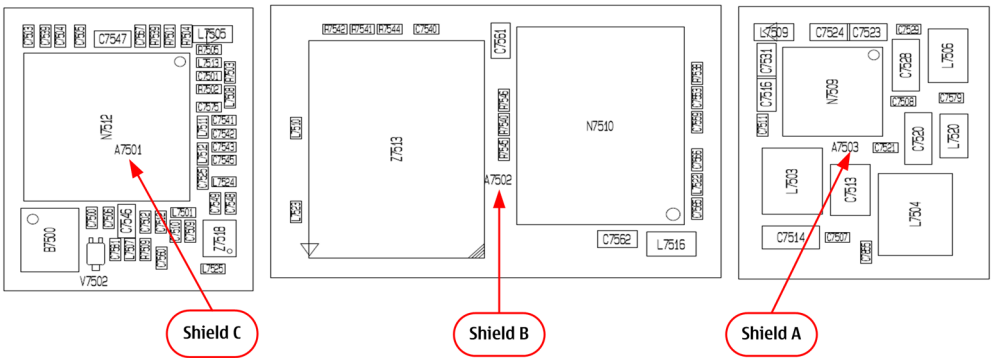


Figure 18 Linko shields

RF shield A is peel-off type and can be opened for repair purposes. The other two RF shield cans (B and C) are solid and should not be opened in service centers.

The maximum height of the shields is 1.70 mm.

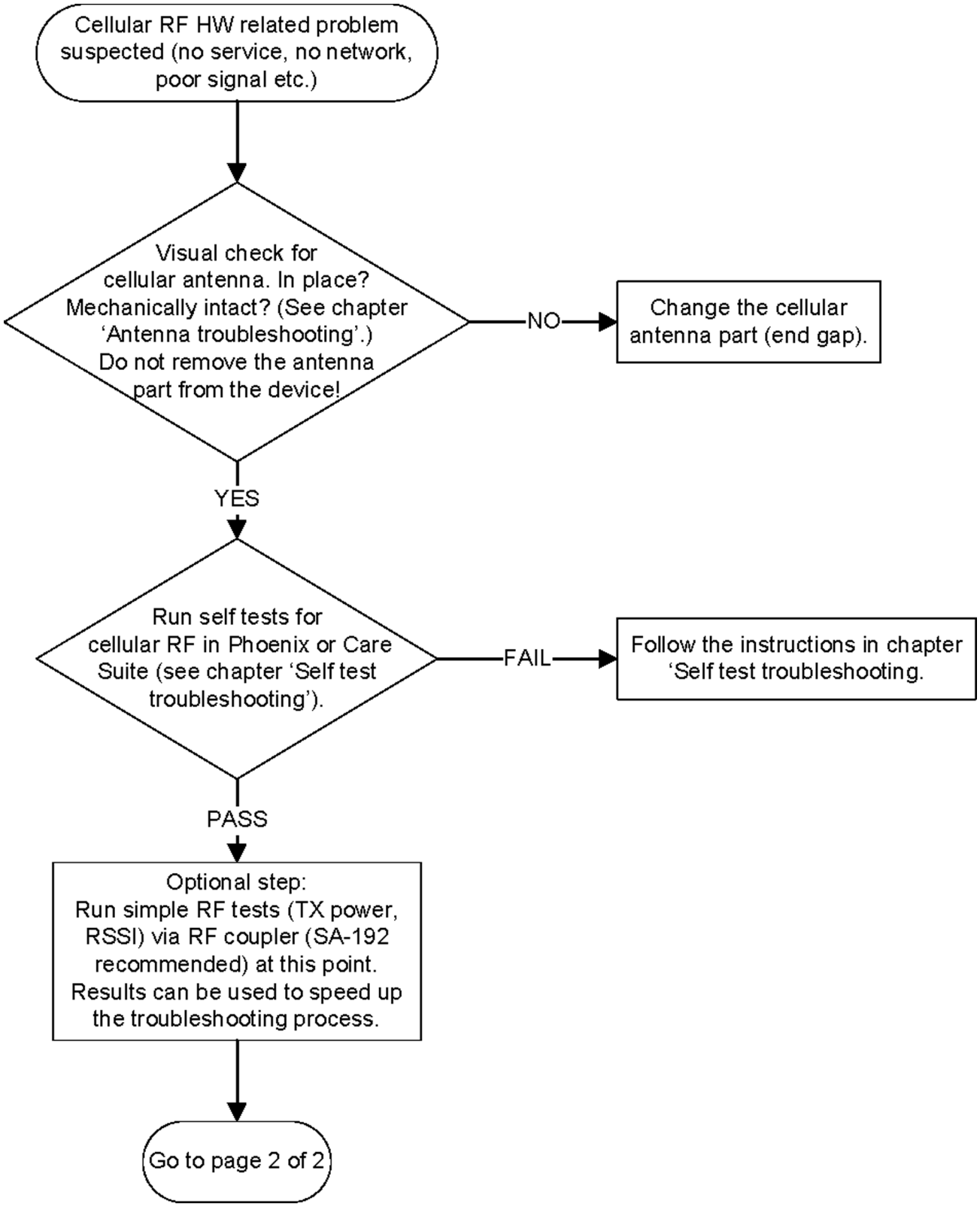
Cellular RF main troubleshooting

Cellular RF main troubleshooting

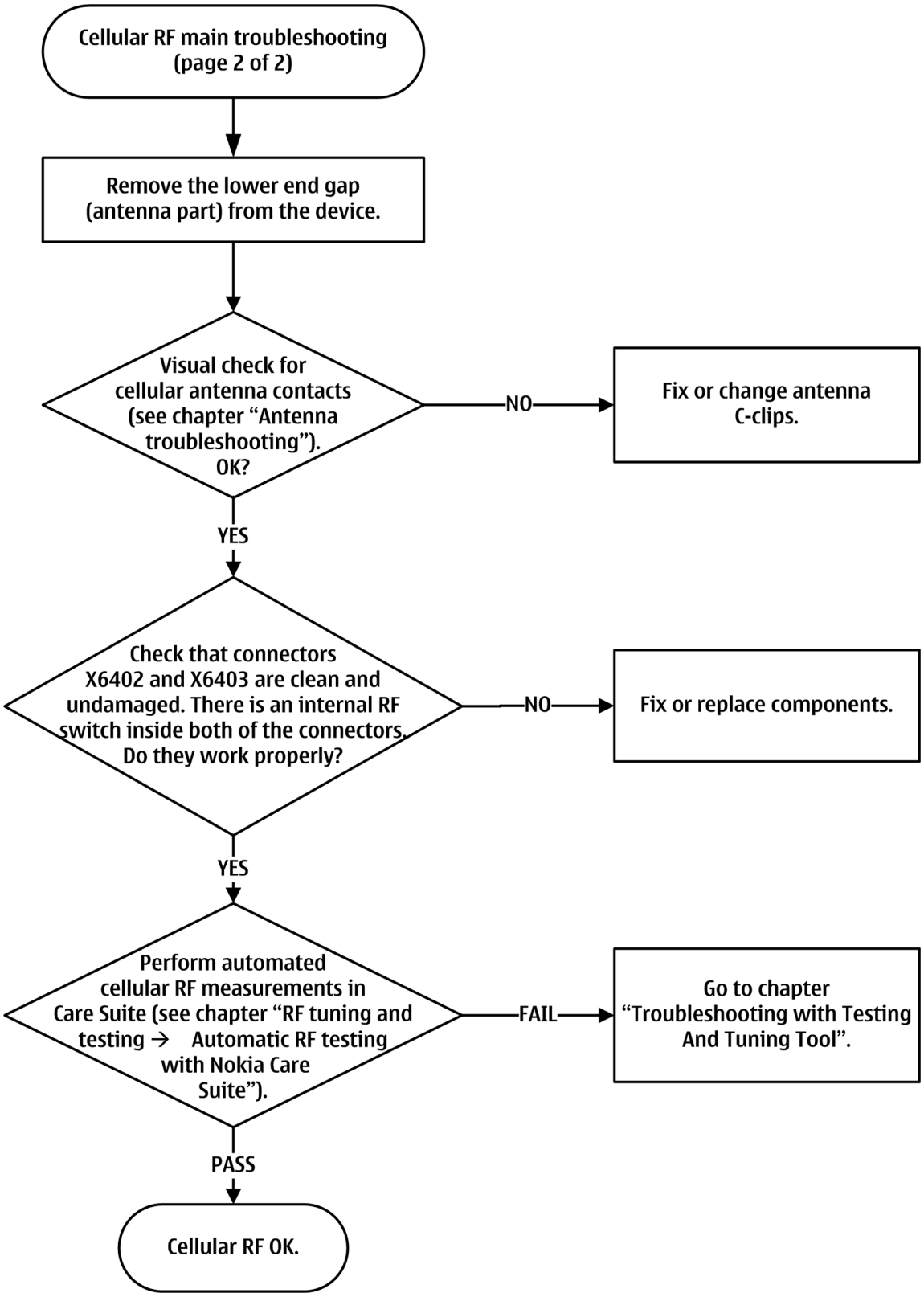
Context

Always start the cellular RF related troubleshooting procedure by following the diagram below.

Troubleshooting flow — Page 1 of 2



Troubleshooting flow — Page 2 of 2



Self test troubleshooting

Troubleshooting with RF Self tests

Context

ÄLLI (N7512) RF ASIC contains test structures that can be used to detect certain RF related errors. In order to use these self tests the most efficient way, it is very important that the tests are performed in a certain order, or at least that the error data is analyzed in this order. The tests are designed so that by going through them in this order it is easy to find the problem component without any redundant checks. The flowcharts presented in this document are based on that idea.

The testing order recommended and used in this troubleshooting guide is the following:

1 ST_CDSP_RF_BB_IF test (ID hex. 56)
   - Tests the functionality of the BB/Linko serial interface & reset lines.
   - If this test fails, it means that there is a problem in programming of the N7512 and all of the following tests cannot give correct data.

2 ST_CDSP_RF_SUPPLY_TEST (ID hex. 53)
   - Tests the functionality of N7512 bias block, regulators, reference voltage line and supply connections, as well as almost all Aura (N7509) regulator voltages..
   - If this test fails, all other N7512 tests can/will fail.

3 ST_CDSP_DIGI_RXTX_IF_TEST (ID hex. 7D)
   - Test checks that the digital RX and TX lines between BB and N7512 are properly connected.

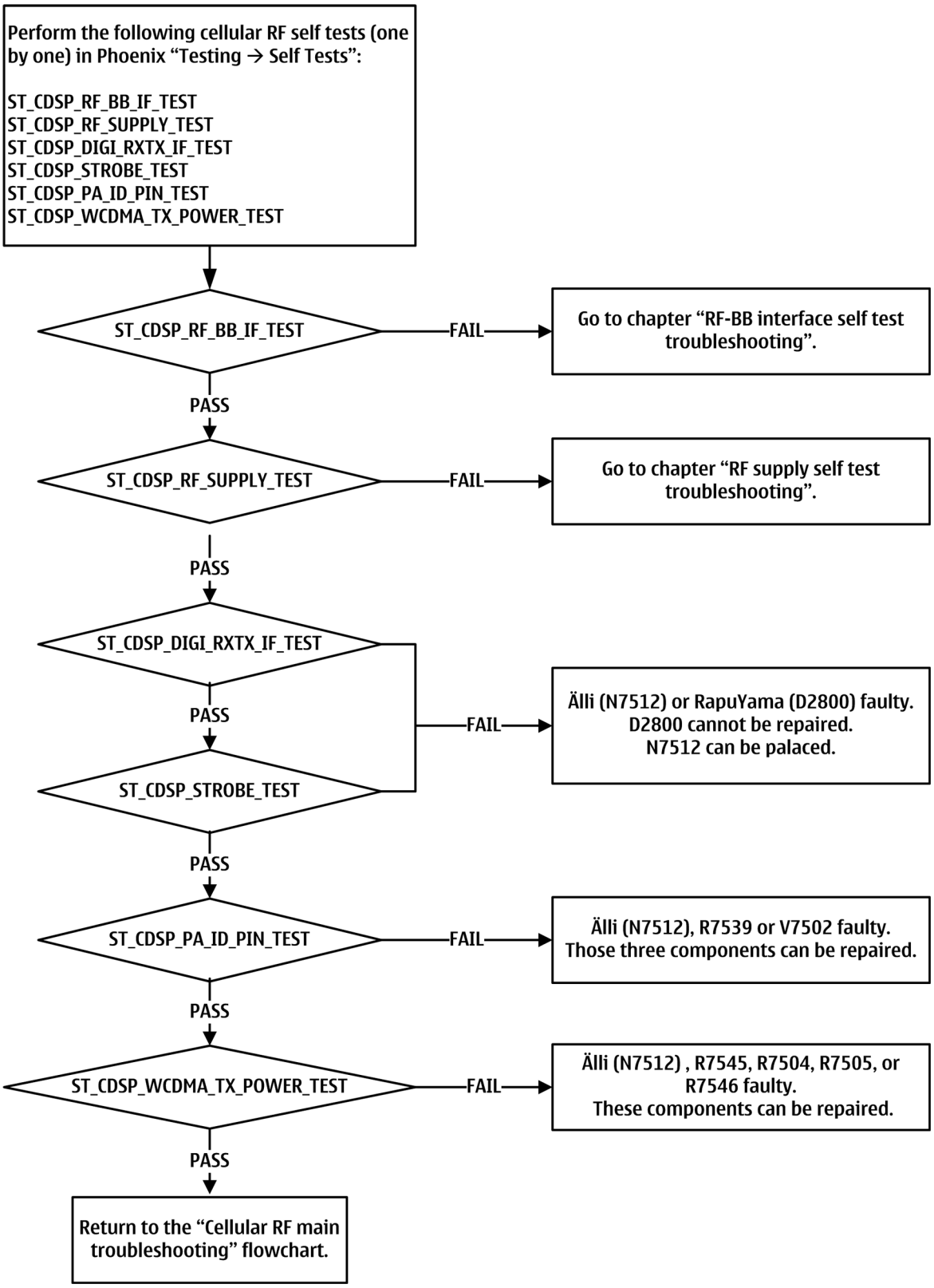
4 ST_CDSP_STROBE_TEST (ID hex. 7C)
   - Tests the functionality of the RFStrobe signal..

5 ST_CDSP_PA_ID_PIN_TEST (ID hex. 7F)
   - The purpose of this test is to identify the PAs of the different vendors.
   - Tests also the functionality of the temperature sensor V7502.

6 ST_CDSP_TX_WCDMA_POWER_TEST (ID hex. 4B)
   - Tests the basic functionality of the WCDMA transmitter.

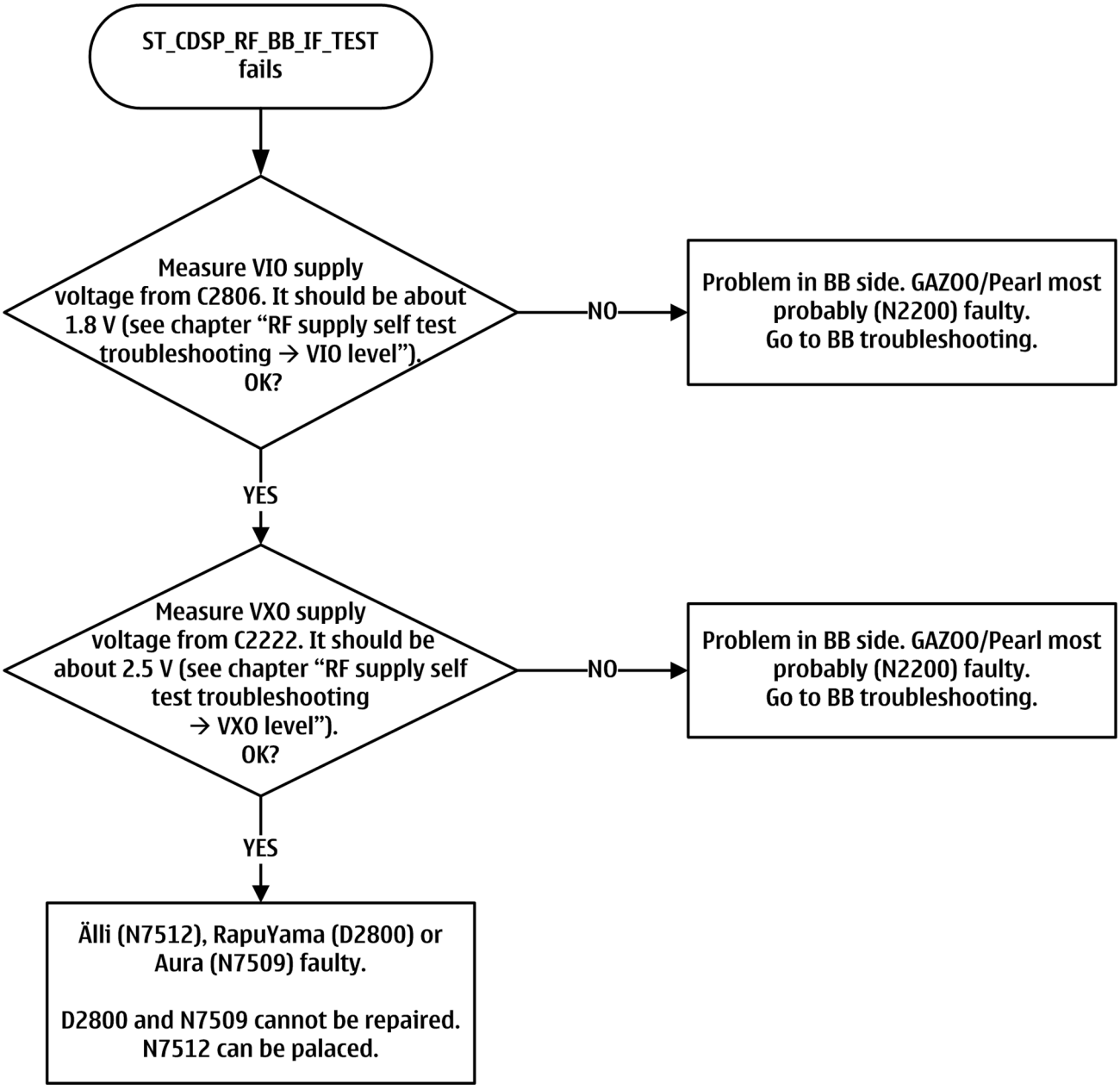
To get the best out of these instructions you need to be have the valid schematics at hand.

Troubleshooting flow



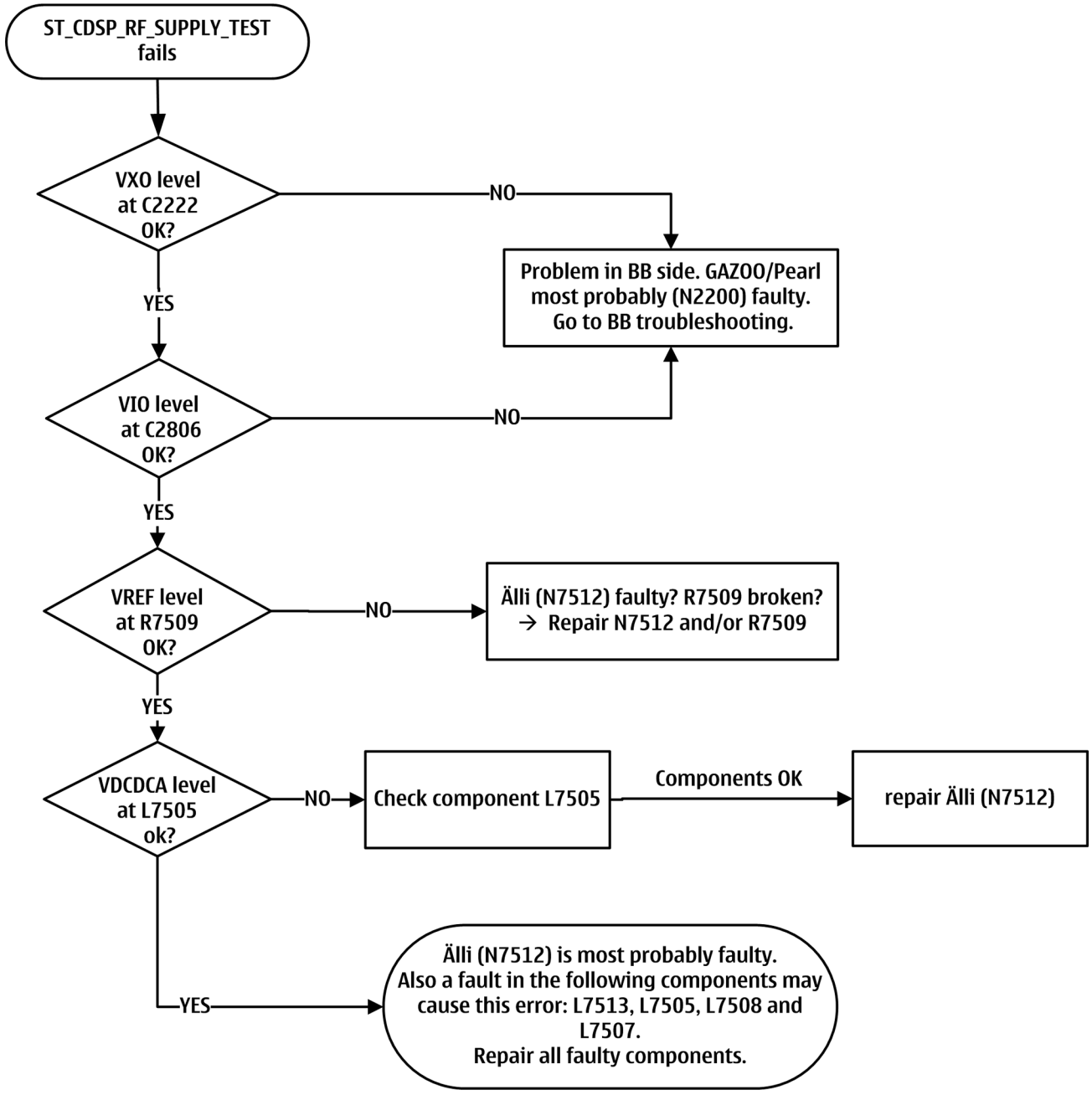
RF-BB interface self test troubleshooting

Troubleshooting flow

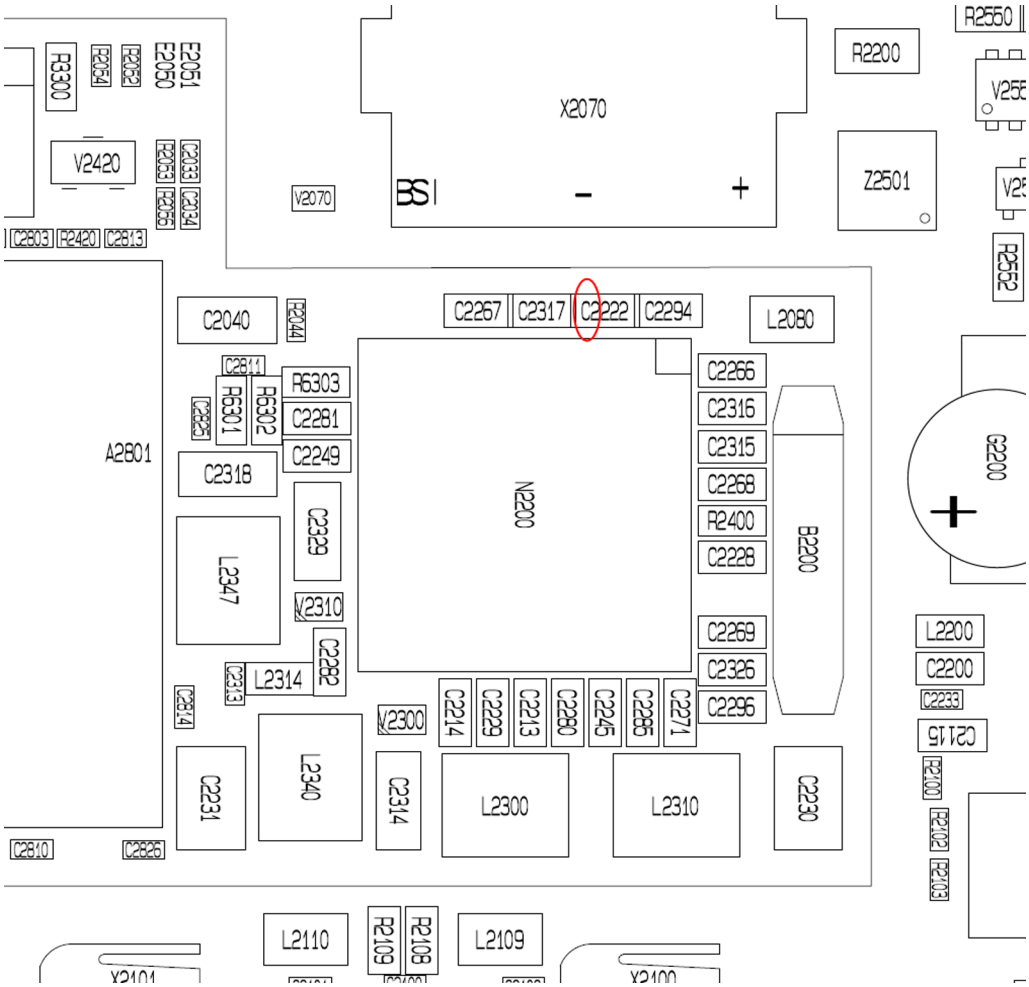


RF supply self test troubleshooting

Troubleshooting flow

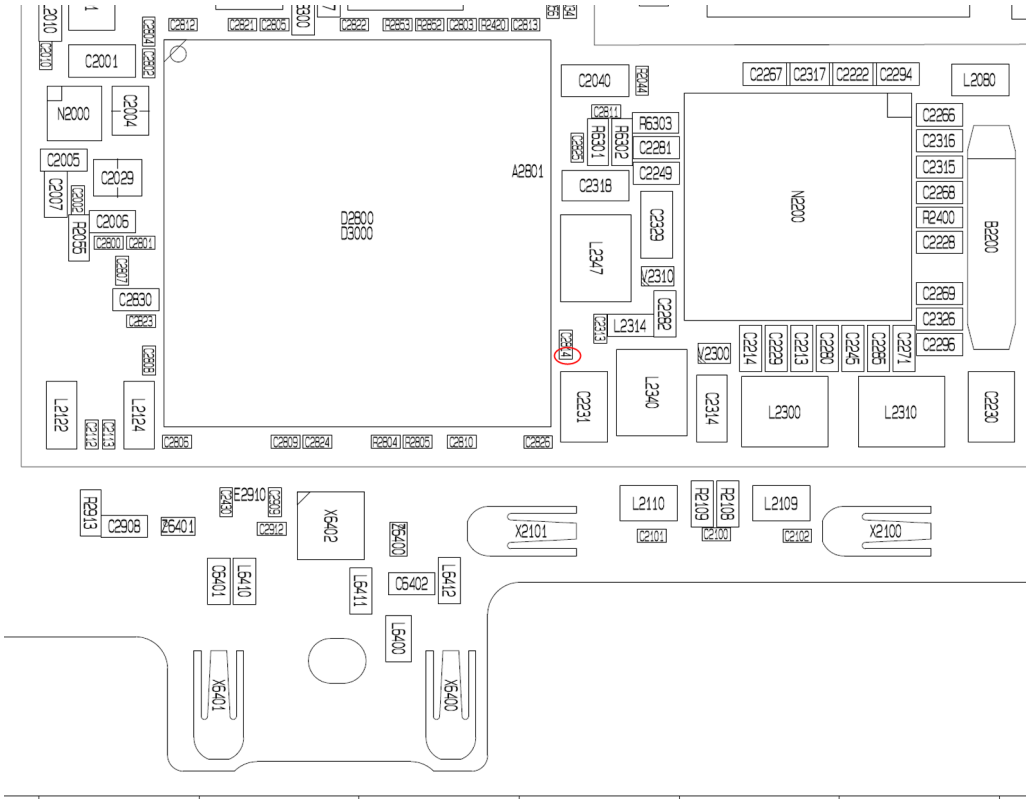


VXO level



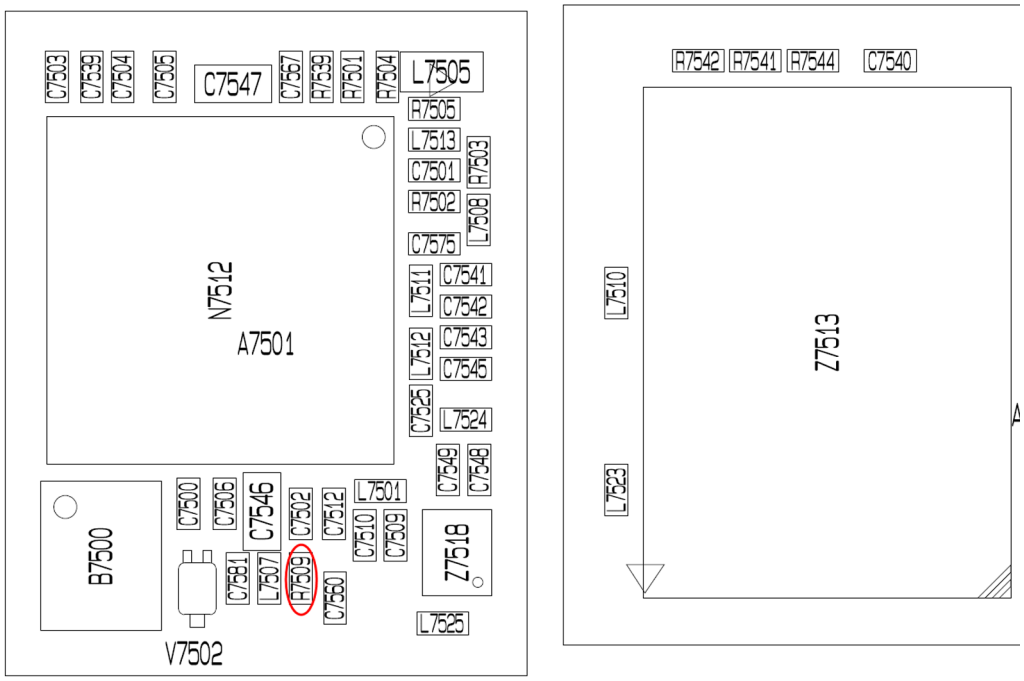
Check the VXO level (2.5V) at C2222. The signal is always on when the phone is in local mode.

VIO level



Check the VIO level (1.8V) at C2814. The signal is always on when the phone is in local mode.

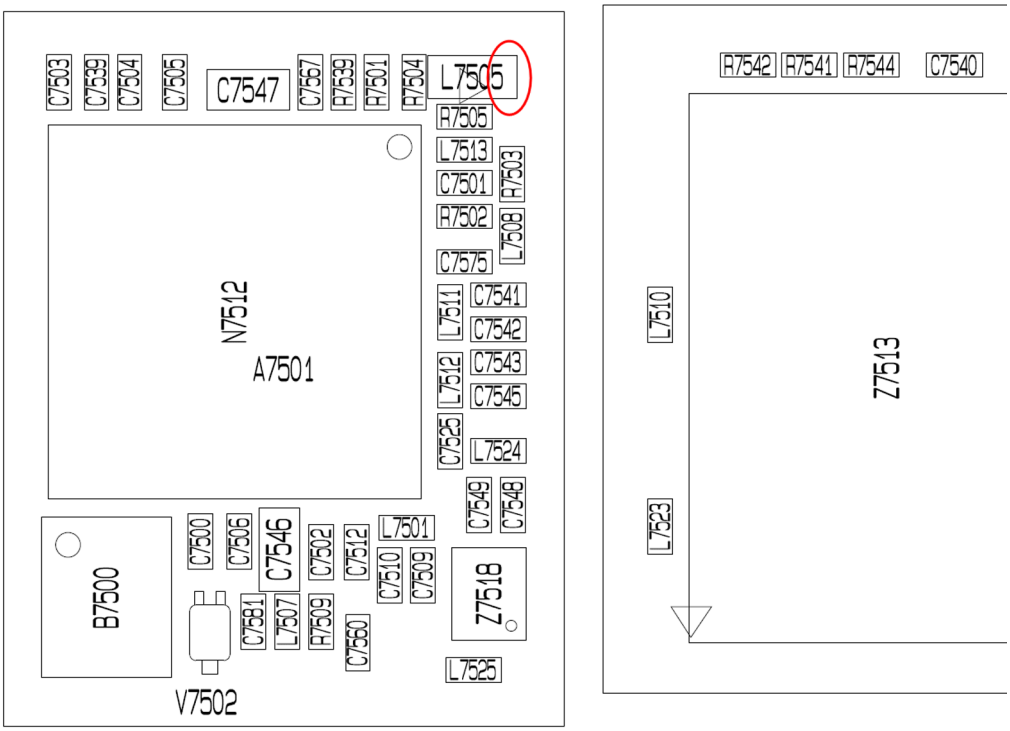
VREF level



Check the Vref level (1.2 V) at C7529.

The GSM or WCDMA transmitter (or receiver) has to be activated before the Vref supply voltage can be measured. Follow the instructions given in chapter 'Manual transmitter (TX) testing with Phoenix → GSM transmitter activation' or 'WCDMA transmitter activation'.

VDCDCA (Vlow) level



Check the VDCDCA level (1.5 V) at C7528.

The WCDMA transmitter has to be activated before the VDCDCA supply voltage can be measured. Follow the instructions given in chapter 'Manual transmitter (TX) testing with Phoenix → 'WCDMA transmitter activation'.

Note: The VDCDCA signal is continuously on when WCDMA TX is activated.

RF tuning and testing

RF auto tuning and testing with Nokia Care Suite

Introduction to cellular RF tunings

RM-640/RM-662 cellular RF engine has been tuned correctly in production. There is no reason to do re-calibration unless one or more of the RF components are changed or memory (D3000) is corrupted.

RM-640/RM-662 can be tuned automatically. Auto tuning is designed to align the phone's RF part easily and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Note: Always perform RF tuning with the help of the module jig MJ-289, never with RF couplers. Using an RF coupler in the tuning phase will cause a complete mistuning of the RF part.

Important: After RF component changes, **always** perform cellular RF auto tuning.

Note: RM-662 is a GSM-only variant so no WCDMA tuning is necessary and possible.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all the RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup. For RF attenuations of the CA-158RS RF cable, please refer to section 'Service Tools and Service Concepts'.

Hardware set up

For hardware requirements for auto tuning, please refer to *RF testing and BB/RF tuning concept with module jig* in section 'Service Tools and Service Concepts'. Please make sure that cellular RF connectors for Low-Band and High-Band are always both connected before voltage is applied to the phone.

Nokia Care Suite preparations

Install Testing And Tuning Tool add-on application to Nokia Care Suite. Automatic RF testing and tuning is not possible without this application. There is no more support in Phoenix to auto tune RM-640/RM-662 product.

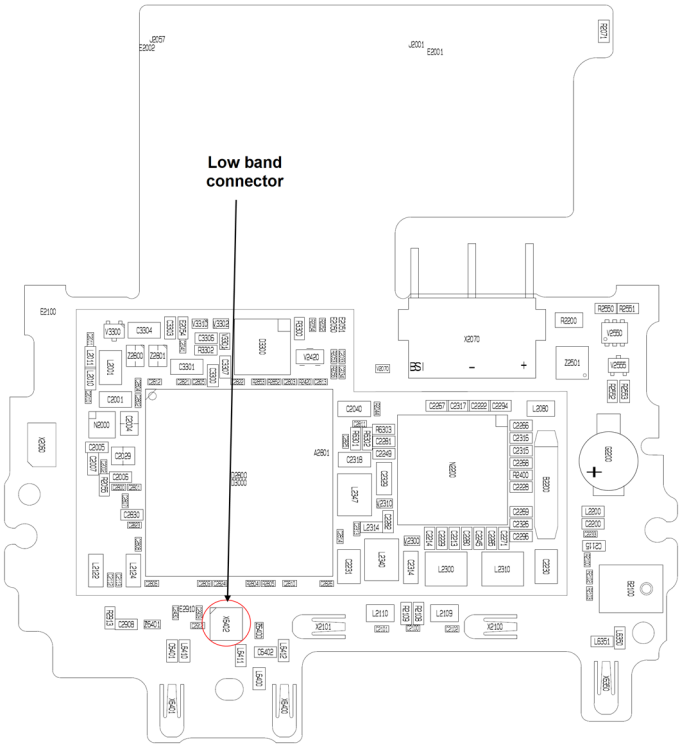
Install the phone specific data package, for example *Nokia_firmware_RM-640_EUROPE_10.014_v41.0.exe*. This defines phone specific settings.

RF auto tuning procedure

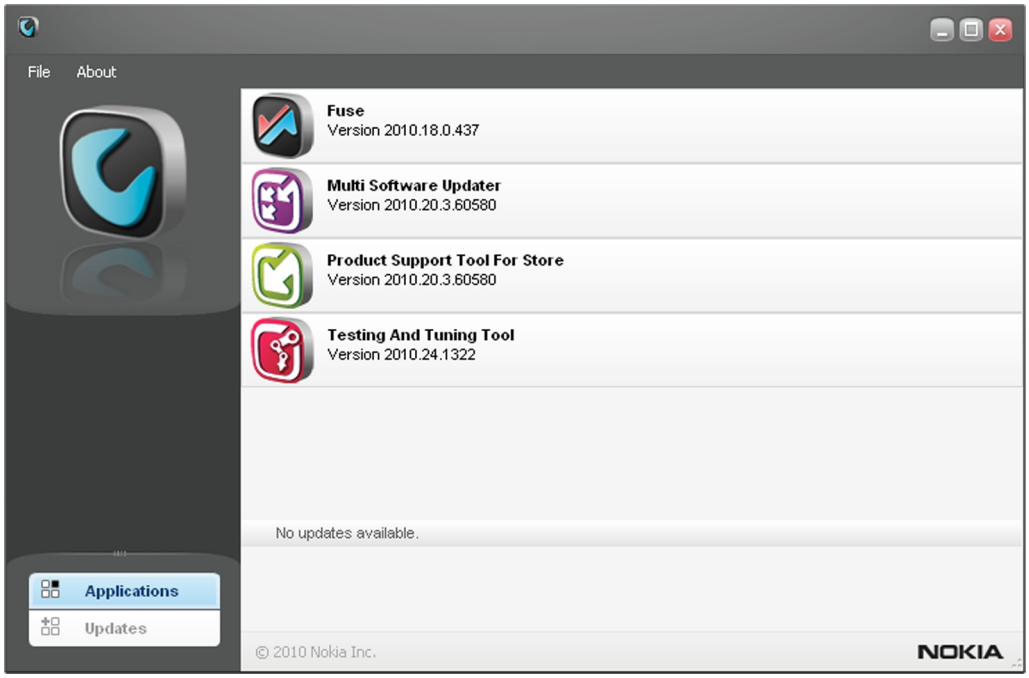
Note: If RF splitter is in use, skip steps 10, 11 and 12.

1 Make sure the phone (in the module jig) is connected to the PC.

2 Connect the RF cable between the phone (low band antenna connector) and the communication tester. If an RF splitter is in use, connect both low and high band antenna cables.



3 Start *Nokia Care Suite* application. The following window opens:

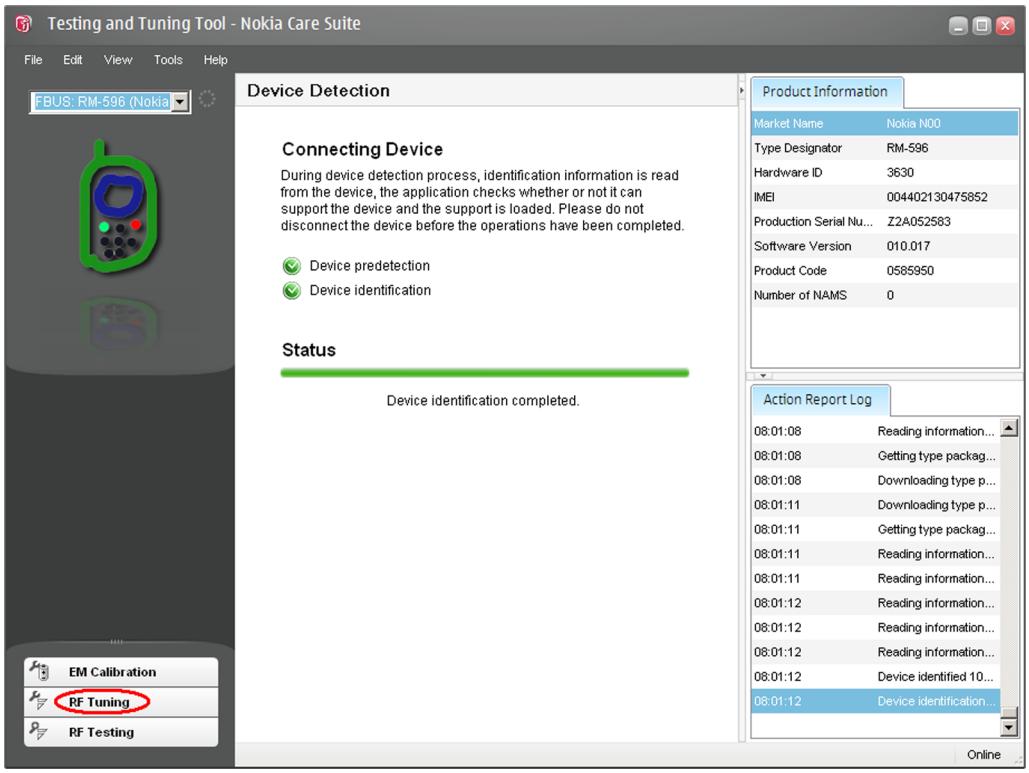


Note: The window appearance may differ depending on the *Nokia Care Suite* version.

Note: *Fuse, Multi Software Updater, Product Support Tool For Store* and *Testing And Tuning Tool* are Care Suite add-on applications. The list is different if there are different add-on applications installed.

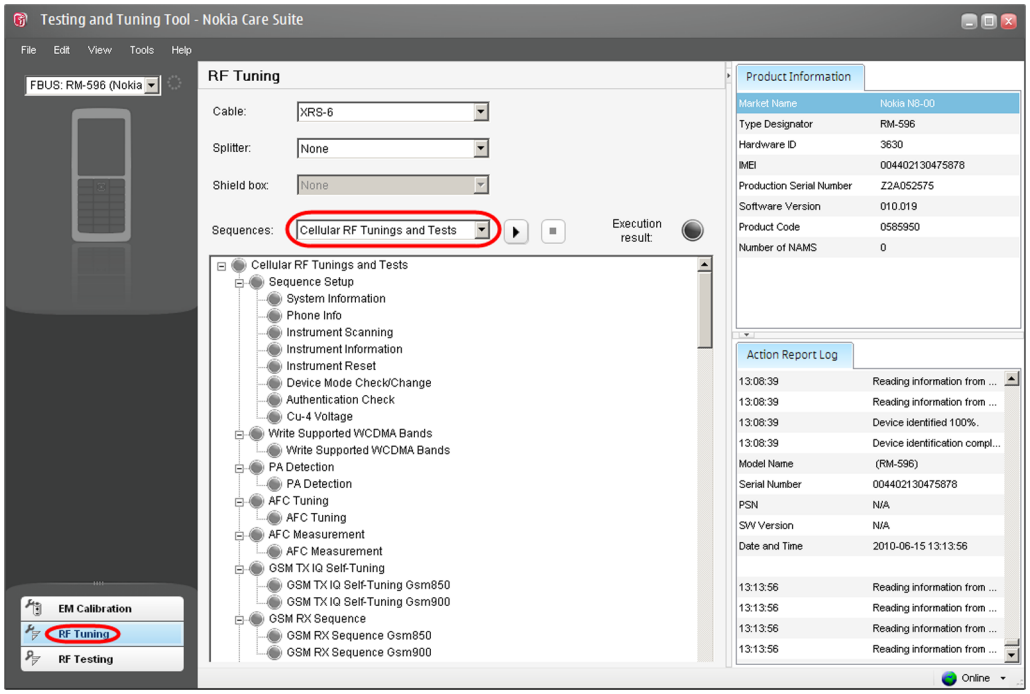
4 To open the application, double-click **Testing And Tuning Tool** icon.

5 If the application is able to find a connected phone, the following view will open:



Note: The window appearance may differ depending on the *Nokia Care Suite* and *Testing And Tuning Tool* versions

6 Click on the **RF Tuning** button. The following view opens:

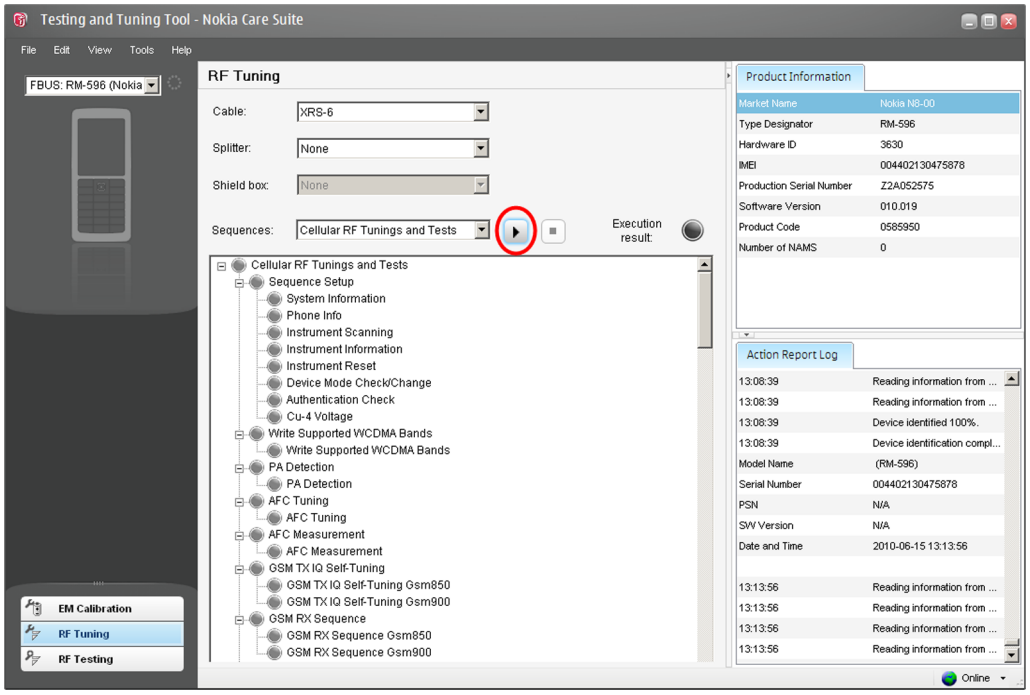


Note: The window appearance may differ depending on the *Nokia Care Suite* and *Testing And Tuning Tool* versions

7 Select **Cellular RF Tunings and Tests** from the drop-down menu.

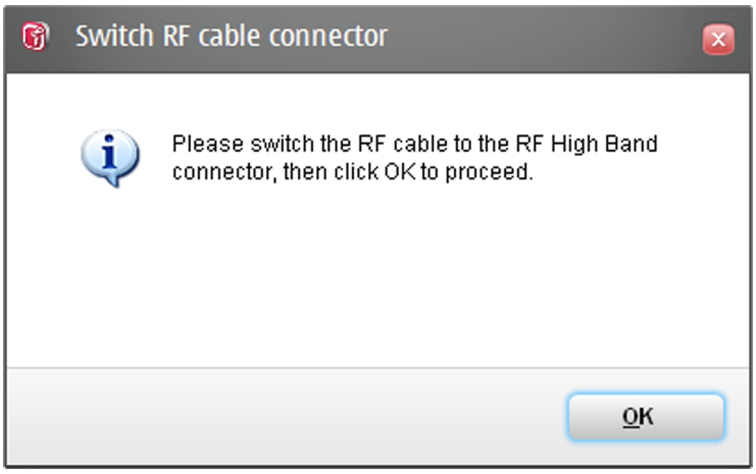
8 Select the RF cable used (and possible RF splitter / RF shield box) from the drop-down menu. CA-158RS attenuation values are always taken automatically into account when RM-640/RM-662 product is connected to *Nokia Care Suite* tool.

9 Click the **Run** button.

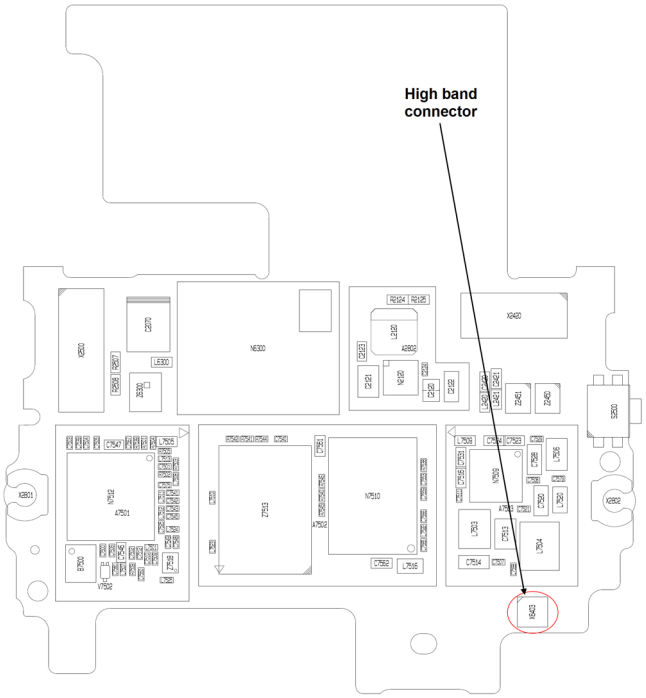


Note: The window appearance may differ depending on the *Nokia Care Suite* and *Testing And Tuning Tool* versions

10 If no critical errors happen during the low band RF tuning procedure, the following window will pop up:



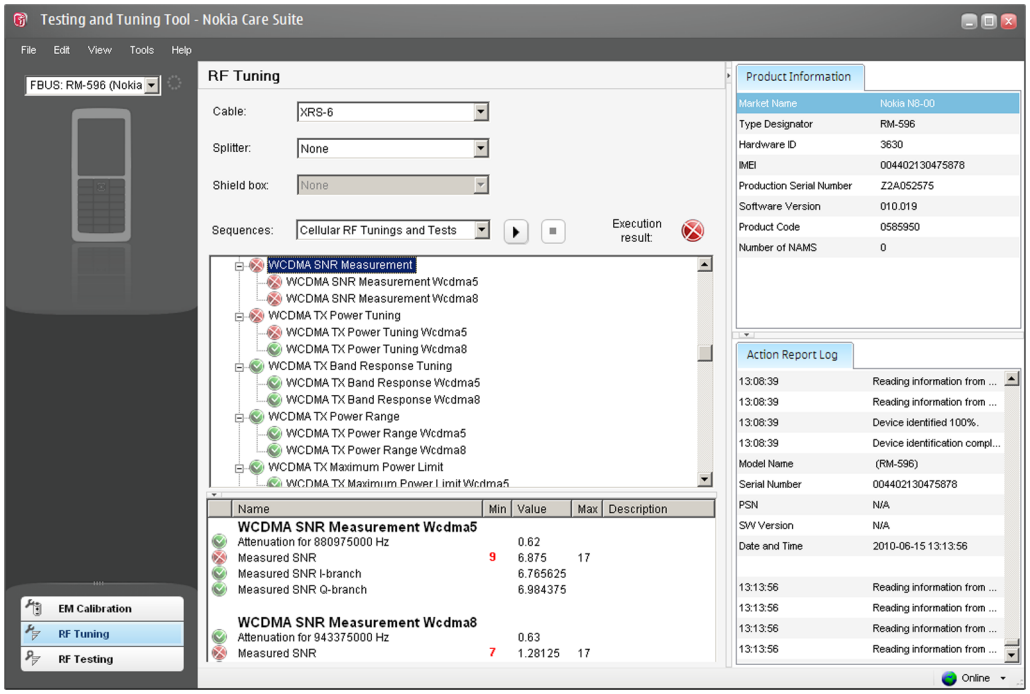
11 Change the CA-158RS cable to the high band RF connector on the phone PWB.



12 Click **OK** and RF tunings will automatically be performed for high cellular bands.

13 RF tunings will be ready when all the tunings and measurements are green in the tool window and no errors occur.

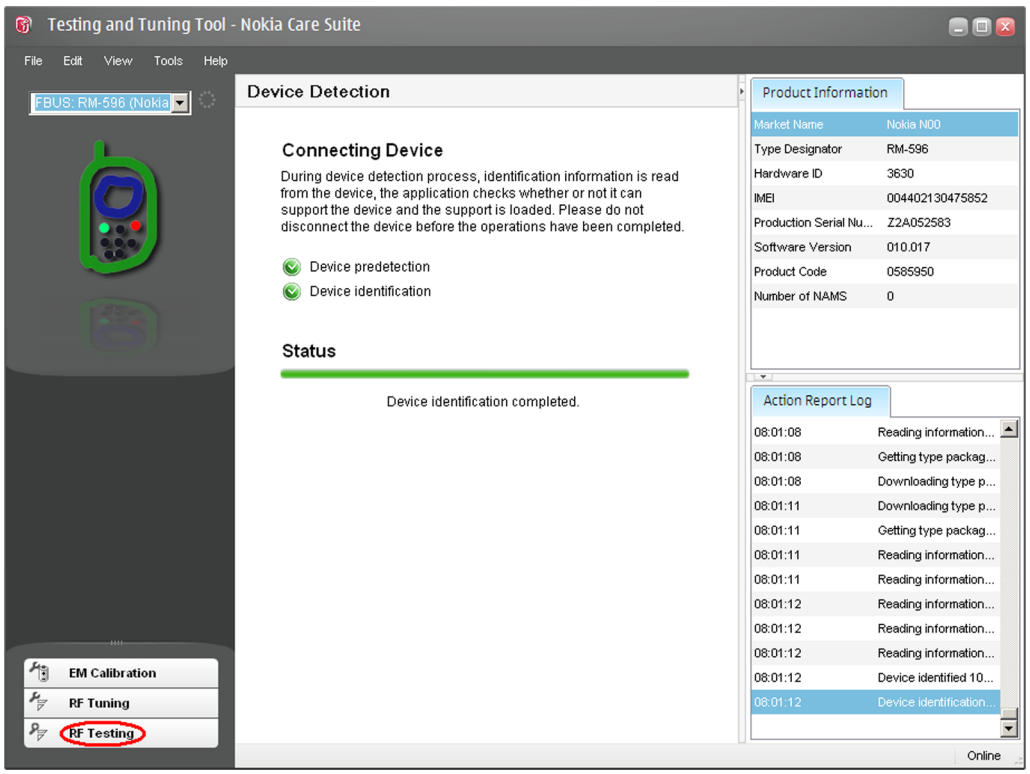
14 If errors do happen, failed tuning/testing steps are marked with a red color and more detailed results are shown on the screen. An example fail case is shown below:

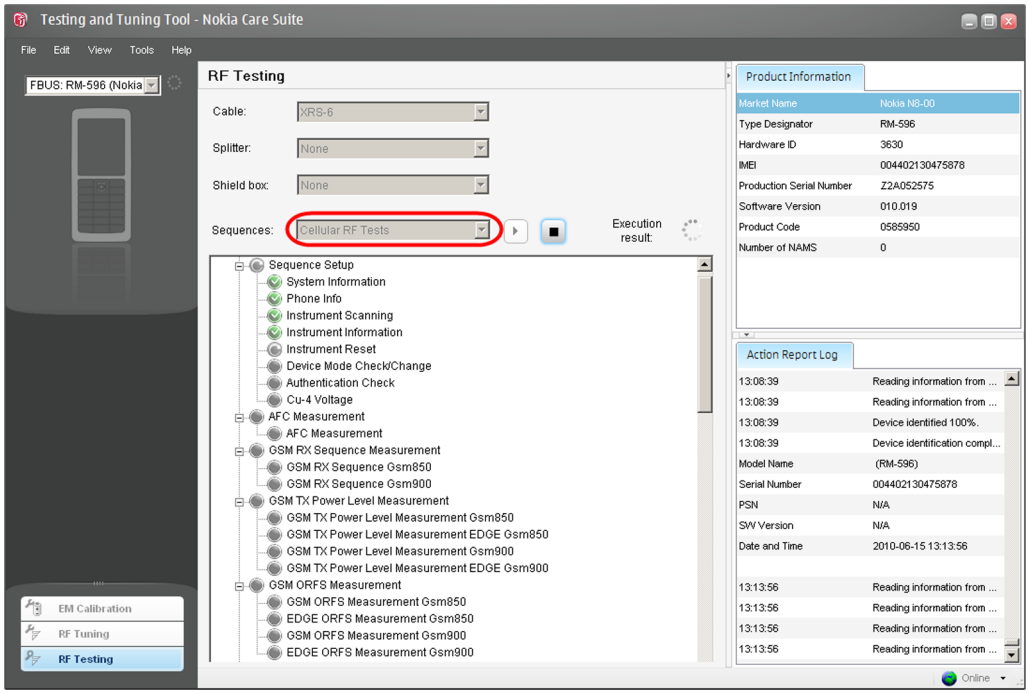


Note: The window appearance may differ depending on the *Nokia Care Suite* and *Testing And Tuning Tool* versions

Automatic RF testing with Nokia Care Suite

Testing And Tuning Tool add-on application can be used also for non-signalling RF tests. The automatic RF testing procedure is the same as explained in the chapter *RF auto tuning procedure*, but **RF Testing** should be selected in the *Testing And Tuning Tool* main window instead of **RF Tuning** .





Note: The window appearance may differ depending on the *Nokia Care Suite* and *Testing And Tuning Tool* versions.

RF Testing selection does all the same measurements as **RF Tuning**, but does not perform any tunings. *RF Testing* is a safe way to check the basic cellular RF performance of the phone. The following test cases will be performed (the complete set of measurements may differ depending on the data package content):

- GSM SNR
- GSM RSSI
- GSM / EDGE TX Power Level
- GSM Modulation & Switching spectrum
- GSM EDGE EVM
- GSM Burst Template
- GSM Phase Error
- WCDMA RSSI
- WCDMA SNR
- WCDMA TX Power Range
- WCDMA TX Max Output Power
- WCDMA ACP
- WCDMA EVM

Troubleshooting with Testing And Tuning Tool

Context

If limit fails occur while RF tests are performed with Testing And Tuning Tool, the user has to be very careful to understand the measurement results. Fails may occur because of many reasons:

1 RF attenuation between the phone and the communication tester is something else as expected by the *Testing And Tuning Tool*. Please check that cable, splitter and shield box selections are correct in the *Testing And Tuning Tool* main window.

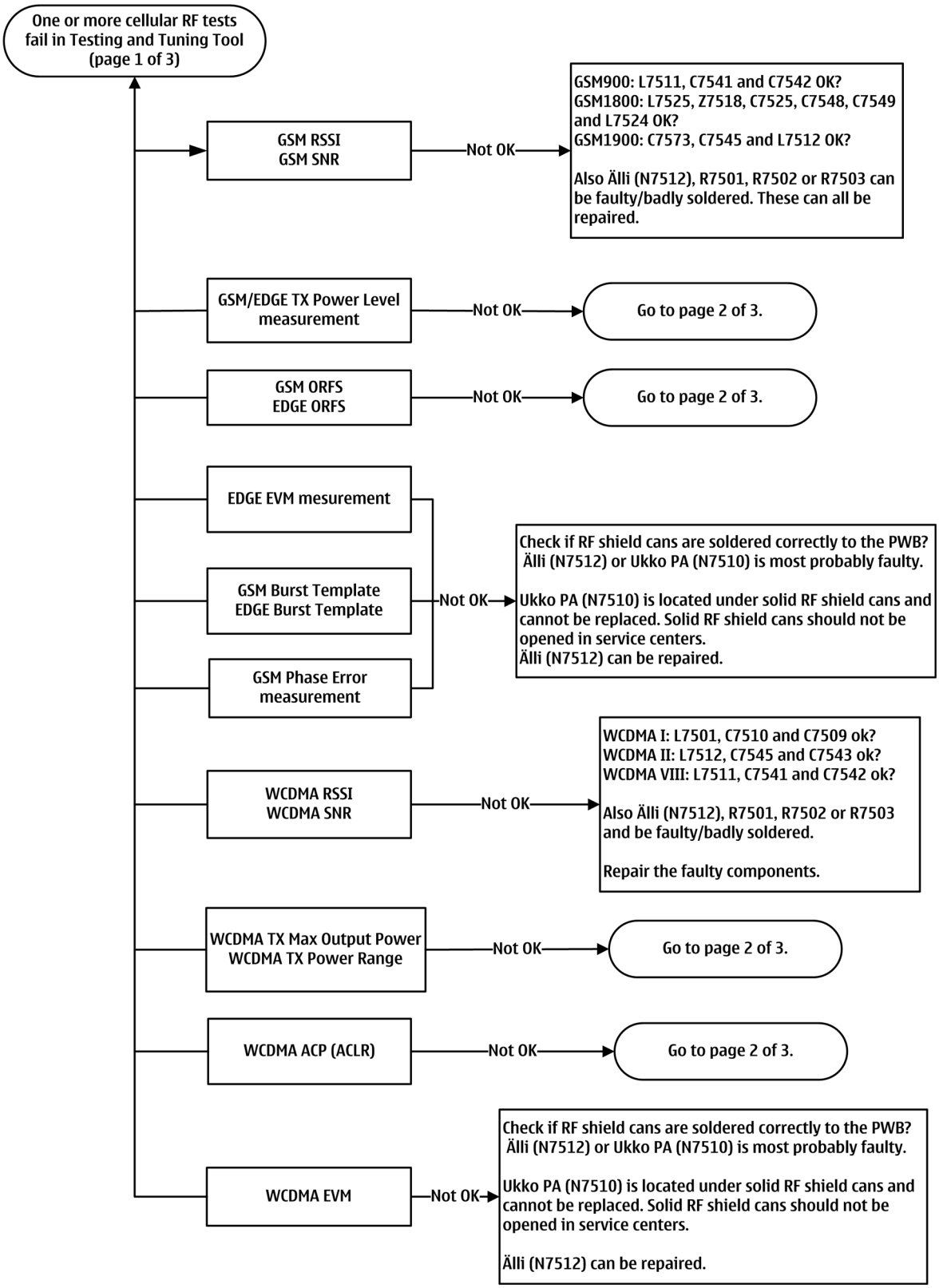
2 Test limits (specified in the product specific data package) are quite tight. Small limit violations do not always mean that the tested product is broken, but the RF performance may not be as good as it should be.

3 RX measurements (RSSI, SNR) may fail because of strong signals from base stations nearby. It is recommended to always perform RF measurements in an RF-shielded environment (in an RF-shield box or room).

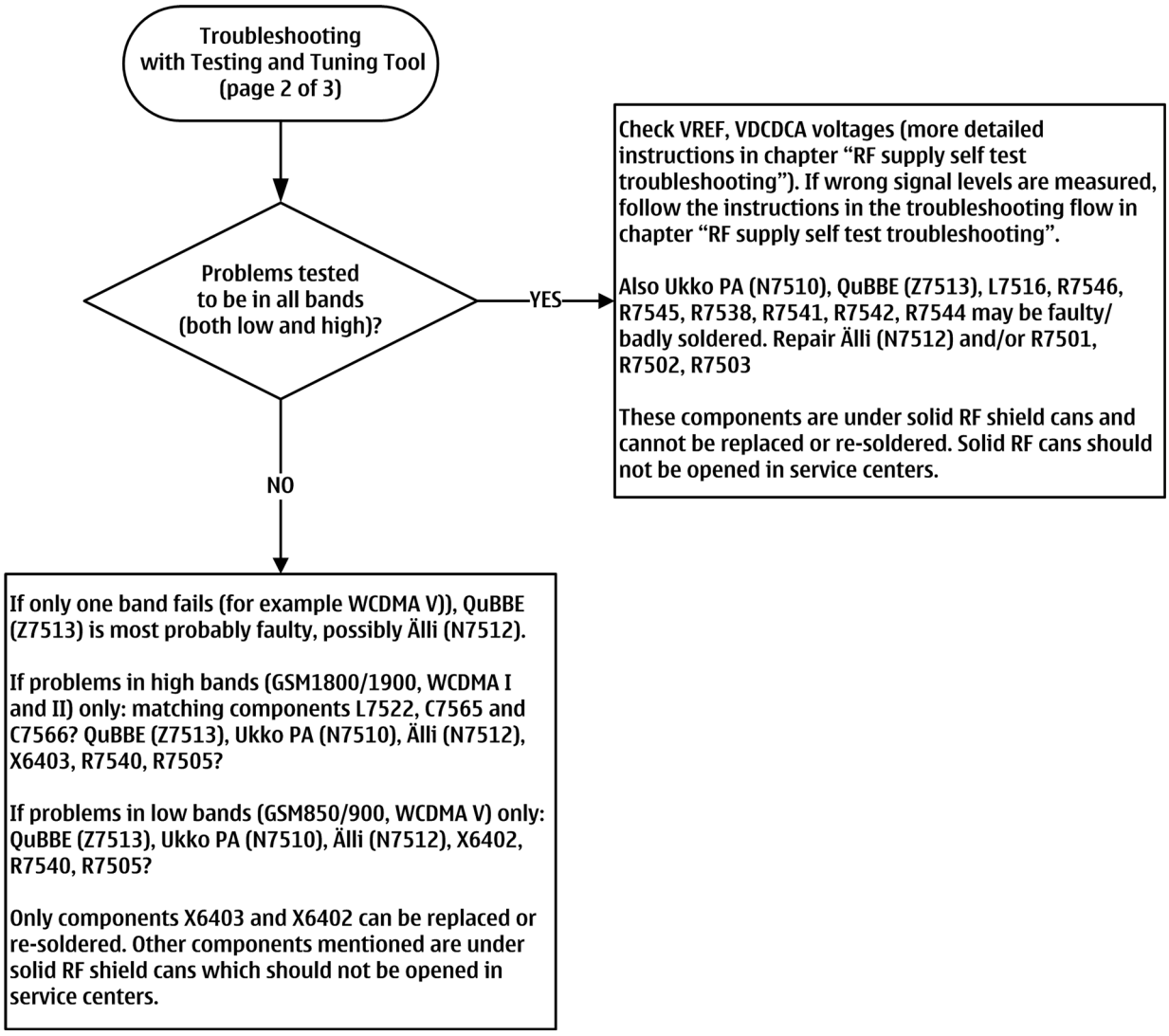
4 The phone is really broken and needs more specific troubleshooting. Typical for these cases is that *RF Testing* gives measurement results which are far from the test limits.

Note: Start the more specific troubleshooting always from the chapter Cellular RF main troubleshooting (page 4–7) . The troubleshooting flow below may be misleading if followed without upper level instructions.

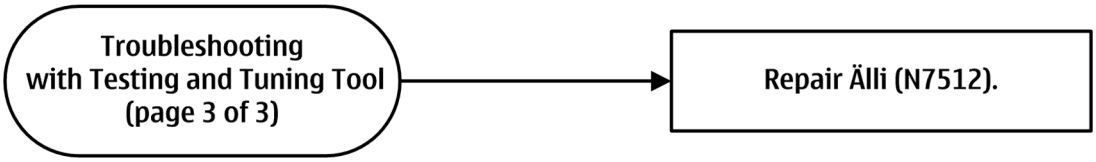
Troubleshooting flow — Page 1 of 3



Troubleshooting flow — Page 2 of 3



Troubleshooting flow — Page 3 of 3



Manual transmitter (TX) testing with Phoenix

General instructions for transmitter (TX) activation

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation
- Do not transmit on frequencies that are in use
- The transmitter can be controlled in local mode for diagnostic purposes

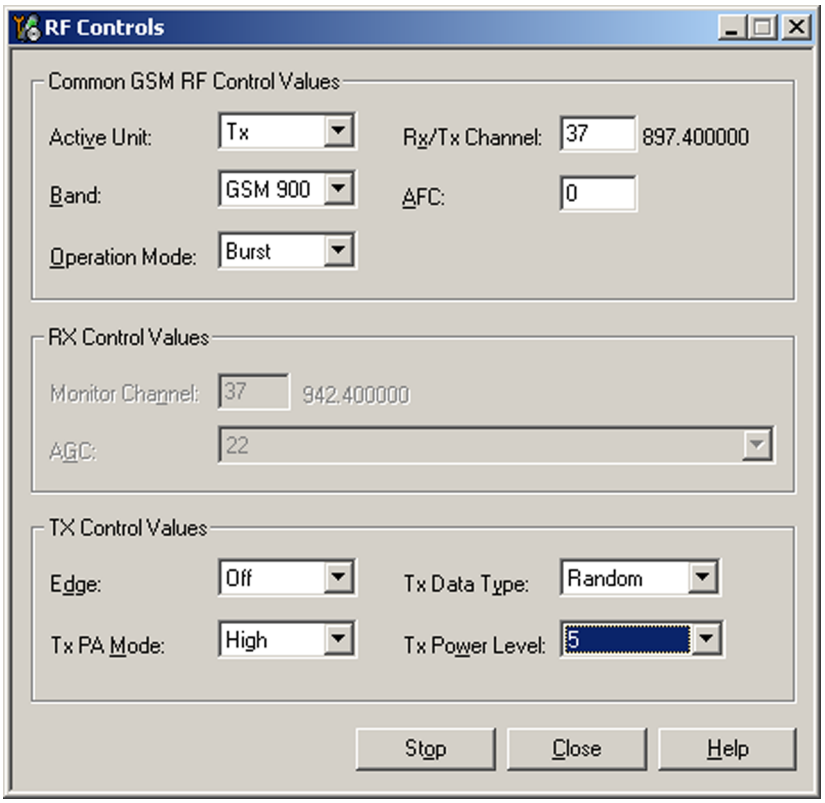
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”, in WCDMA transmitter testing the best tool is “TX Control”

  Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF measurement equipment or at least a 2 W dummy load), otherwise the power amplifier (PA) may be damaged.

GSM transmitter activation

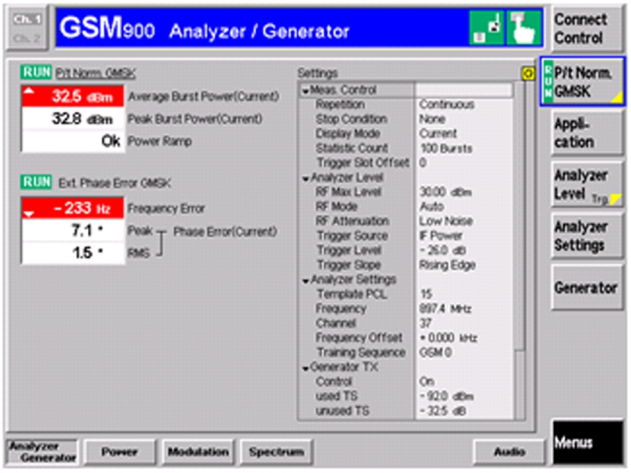
Steps

1. Set the phone to local mode.
2. Activate the RF controls tool in Phoenix (**Testing** → **GSM** → **RF Controls**).
3. Make settings as shown in the figure:

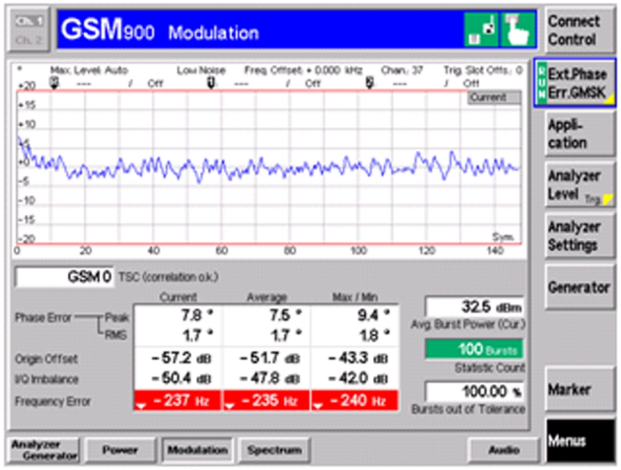


4. GSM transmitter is activated when **Active Unit** is set to “Tx”. Aura (N7509) supply voltages are on for measurement purposes after this step is completed.
5. *Optional step (not needed if GSM TX activation only required):* Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum) manually, using a communication analyzer (for example CMU–200). Change power level (in “RF Controls” tool) and make sure the power reading follows accordingly.

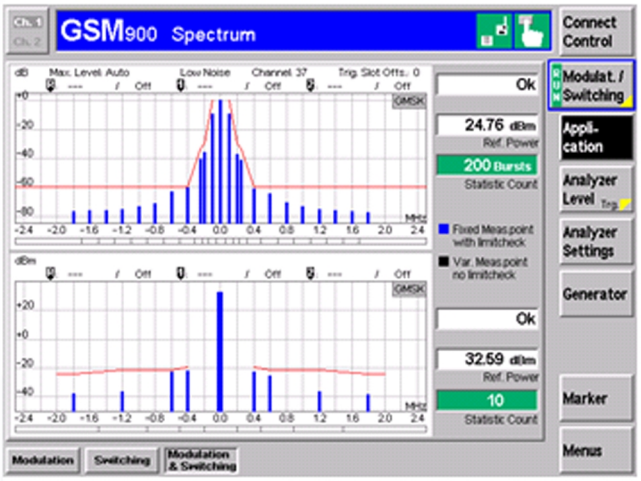
Analyser settings



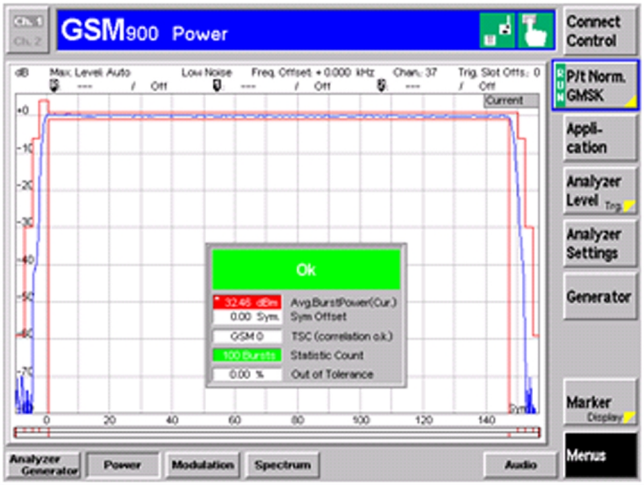
Phase error



Modulation/Switching spectrum



Power/Burst GSM/GPRS (GMSK)

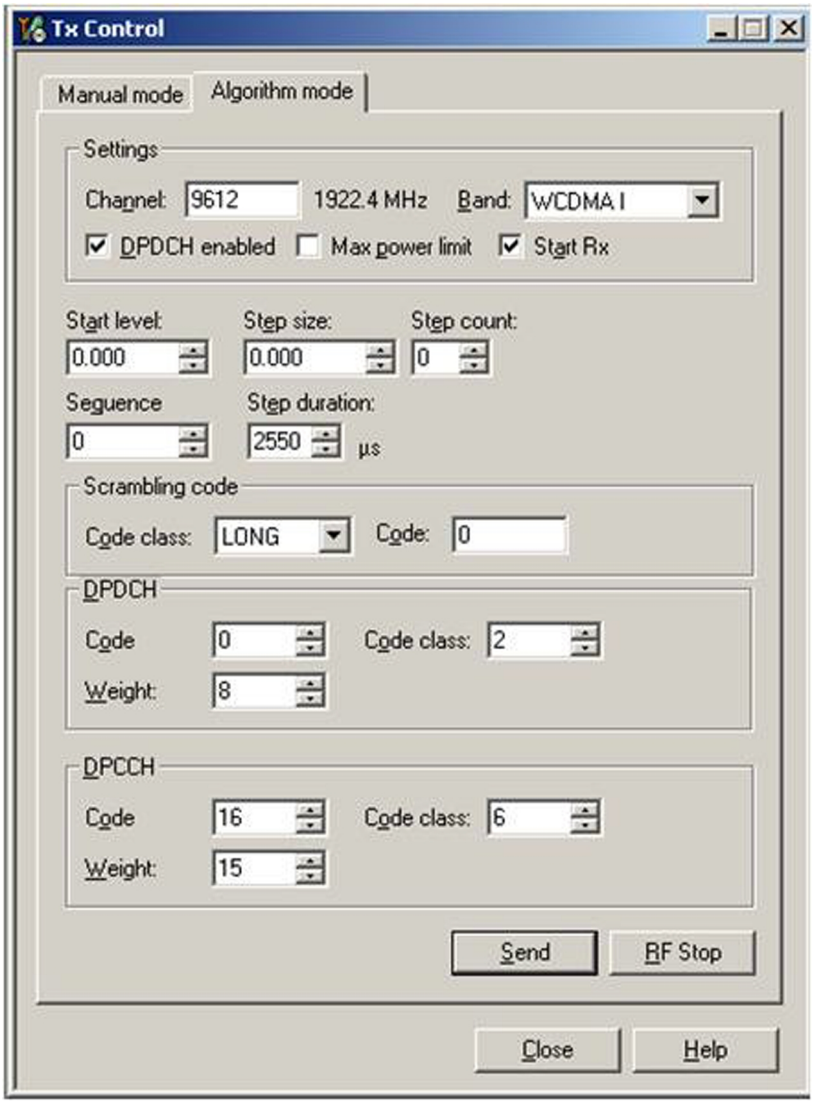


Power/Burst - EDGE (8PSK)

WCDMA transmitter activation

Steps

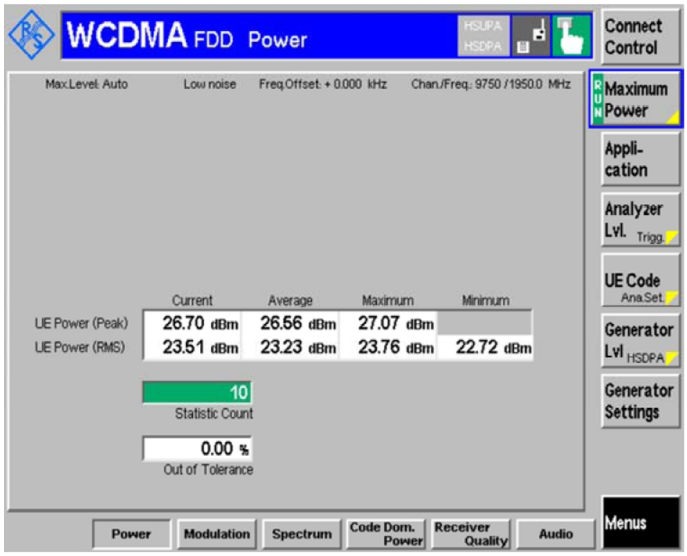
1. Set the phone to local mode.
2. In Phoenix, select **Testing** → **WCDMA** → **TX Control** .
3. Select **Algorithm mode** tab.
4. In the TX Control window, make settings as in the figure:



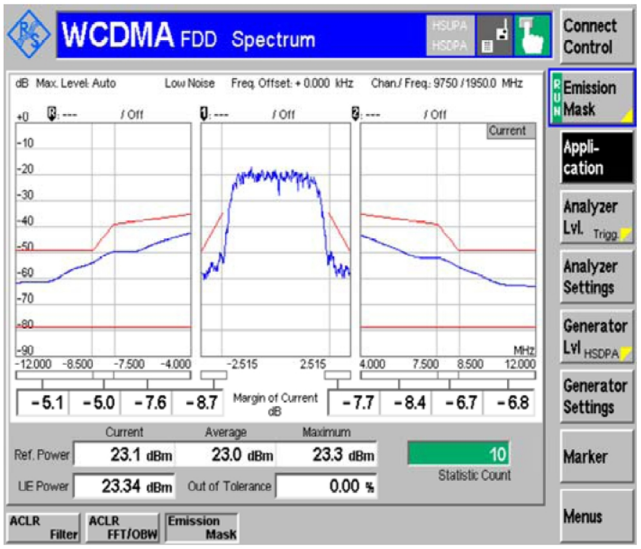
5. Click **Send** to enable the settings and activate TX. If settings are changed (e.g. new channel or power level), you have to click **RF Stop** and **Send** again. Aura (N7509) supply voltages are on for measurement purposes after this step is completed.
6. *Optional step (not needed if WCDMA TX activation only required):* Check the basic TX parameters using a communication analyzer (for example CMU–200).

   Note: RM-640 WCDMA TX power classes: WCDMA I, IV, V and VIII class 3 (maximum output power +24 dBm), WCDMA II class 4 (maximum output power +21 dBm).

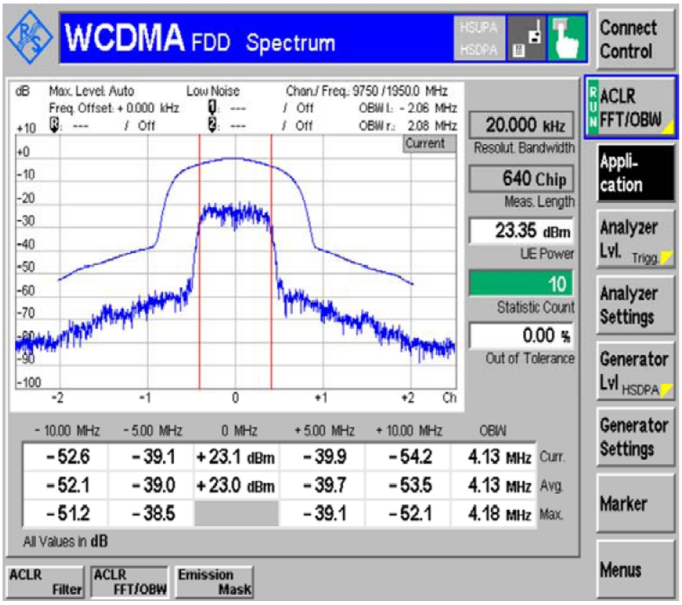
Power



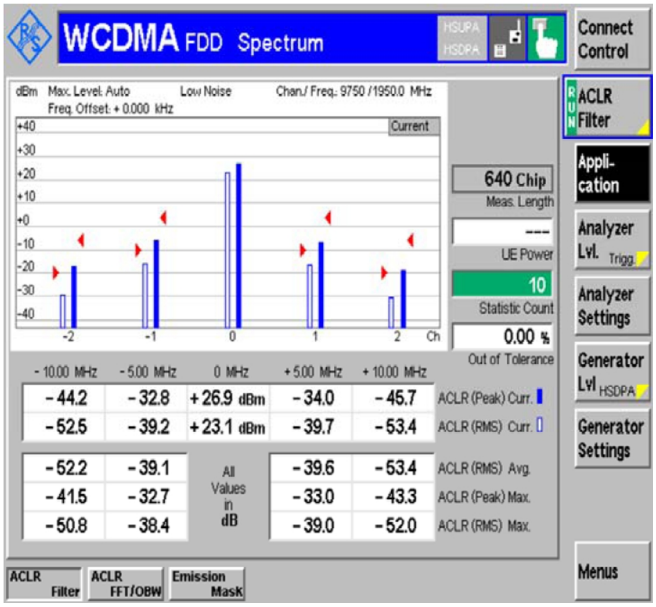
Spectrum - Emission Mask



Spectrum - ACLR (FFT/OBW)



Spectrum - ACLR (Filter)



Manual receiver (RX) testing with Phoenix

General instructions for manual receiver testing

RX can be tested manually by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The most important RX measurement in local mode is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see chapter *GSM RX chain activation for manual measurements/GSM RSSI measurement*. For a similar test in WCDMA mode, see chapter *WCDMA RSSI measurement*.

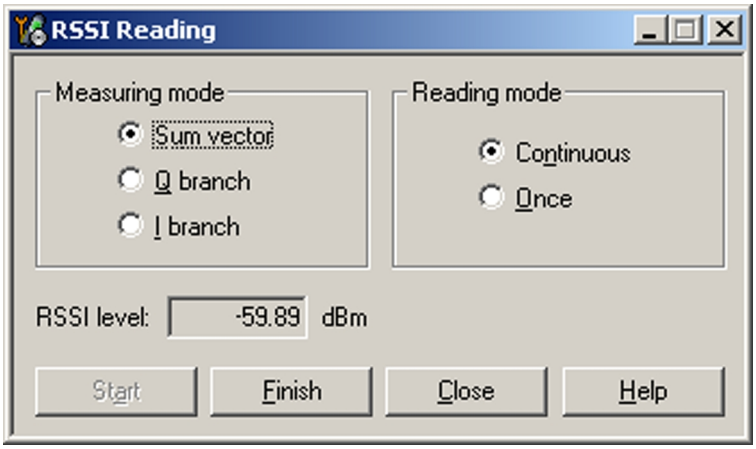
GSM RX chain activation for manual measurements/GSM RSSI measurement

Prerequisites

Connect a signal generator to a proper RF connector on the phone PWB (note: there are two antenna connectors for cellular RF on the phone PWB, one for low bands and one for high bands).

Steps

1. Set the phone to local mode.
2. Activate GSM RSSI reading in Phoenix (**Testing** → **GSM** → **RSSI Reading**)



3. Use the following frequencies and RF levels in RF generator for different GSM bands:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix: *Monitor Channel*	190	37	700	661
RF frequency	881.6 MHz	942.4 MHz	1842.8 MHz	1960.0 MHz
Signal generator frequency	881.66771 MHz	942.46771 MHz	1842.86771 MHz	1960.06771 MHz
Signal generator RF level (CW signal)	-60dBm	-60dBm	-60dBm	-60dBm

Results

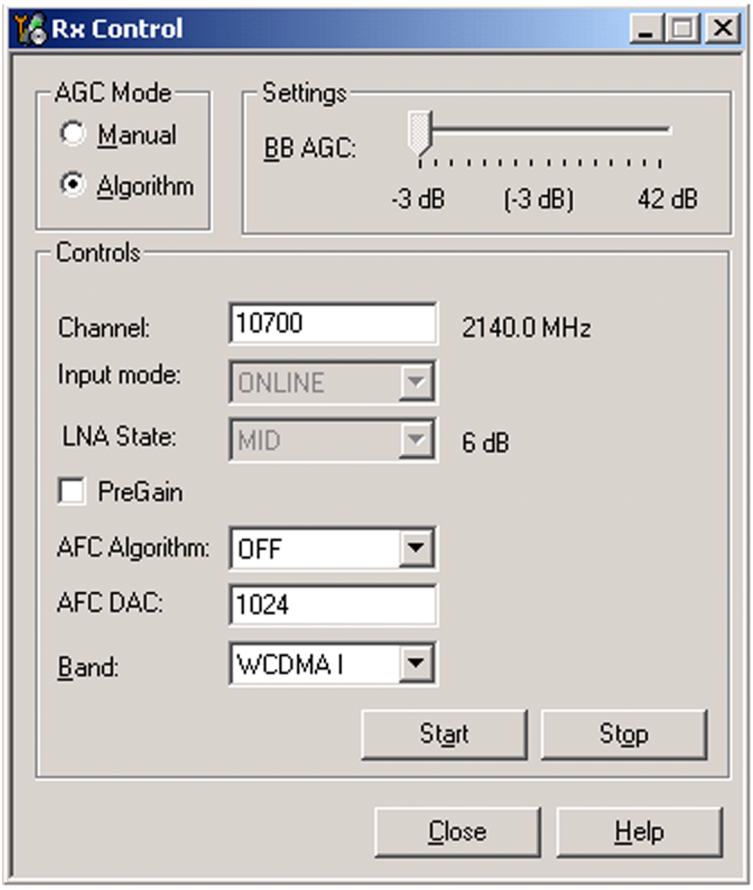
The *RSSI level* reading should reflect the level of the signal generator (- losses) +/- 5 dB.

When varying the level in the range of -30 to -102 dBm, the reading should follow within +/-5 dB.

WCDMA RX chain activation for manual measurement

Steps

1. Set the phone to local mode.
2. Activate *RX Control* tool in Phoenix **(Testing —> WCDMA —> RX Control)** .
3. In the RX Control window, make the following settings:



4. Click **Start** to activate the WCDMA RX. If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Channels for testing: WCDMA I 10700, II 9800, V 4408, VIII 3012.

   Note: Clicking **Stop** also disables TX control if it was active.

WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to chapter *WCDMA RX chain activation for manual measurement*. Connect a signal generator to a proper RF connector on the phone PWB (note: there are two antenna connectors for cellular RF on the phone PWB, one for low bands and one for high bands).

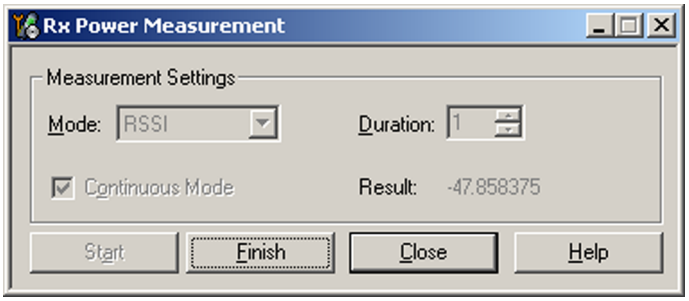
Steps

1. Use the following frequencies and RF levels in RF generator for different WCDMA bands:

Setting	WCDMA I	WCDMA II	WCDMA V	WCDMA VIII
Phoenix: *Channel*	10700	9800	4408	3012
RX frequency	2140.0 MHz	1960.0 MHz	881.6 MHz	942.4 MHz
Signal generator frequency	2141.0 MHz	1961.0 MHz	882.6 MHz	943.4 MHz

Setting	WCDMA I	WCDMA II	WCDMA V	WCDMA VIII
Signal generator RF level (CW signal)	-48 dBm	-48 dBm	-48 dBm	-48 dBm

2. Activate WCDMA RSSI reading in Phoenix **(Testing —> WCDMA —> Rx Power Measurement)** .
3. In the Rx Power Measurement window, make the following settings:



4. Click **Start** to perform the measurement.

Results

The *Result* reading should reflect the level of the signal generator (- losses) +/- 5 dB.

When varying the level in the range of -40 to -100 dB, the reading should follow within +/- 5 dB.

> **Note:** In some versions of the Phoenix service tool, the *WCDMA Rx Power Measurement* tool does not work as it should. In these cases, the result is something really small (for example -8387684.9).

Antenna

Antenna overview

RM-640/RM-662 has two internal antennas:

- The main antenna which is integrated to the lower end gap of the phone
- WLAN/Bluetooth antenna below the upper end gap of the phone

The main antenna covers GSM and WCDMA bands and has separate antenna feeds for low and high bands. Connection from the phone PWB to the antenna flex is implemented by C-Clips. The main antenna consists of an antenna flex which is integrated between two plastic parts in the lower end gap of the phone.

Antenna troubleshooting

Cellular antenna

The main antenna has two connection pads. Check that these pads have a proper contact to the C-clips on the phone PWB. Check also that both C-clips exist and work properly.

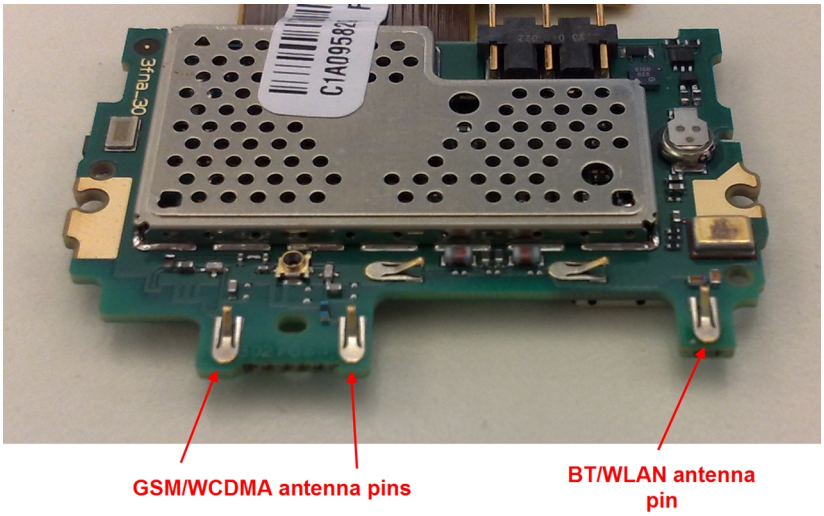


Figure 19 C-clips for GSM/WCDMA antenna

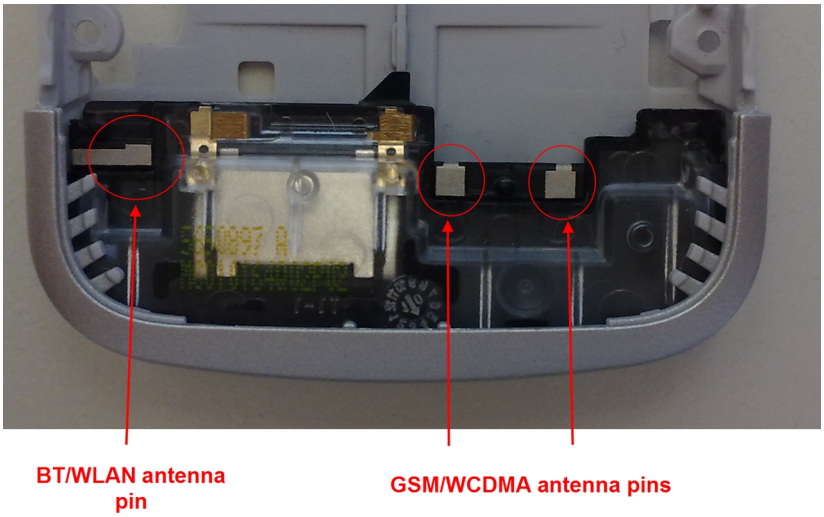


Figure 20 Pads of GSM/WCDMA antenna

WLAN/BT

Check that the only pad in the WLAN/Bluetooth takes a proper contact to the C-clip on the phone PWB and the C-clip is clearly open.

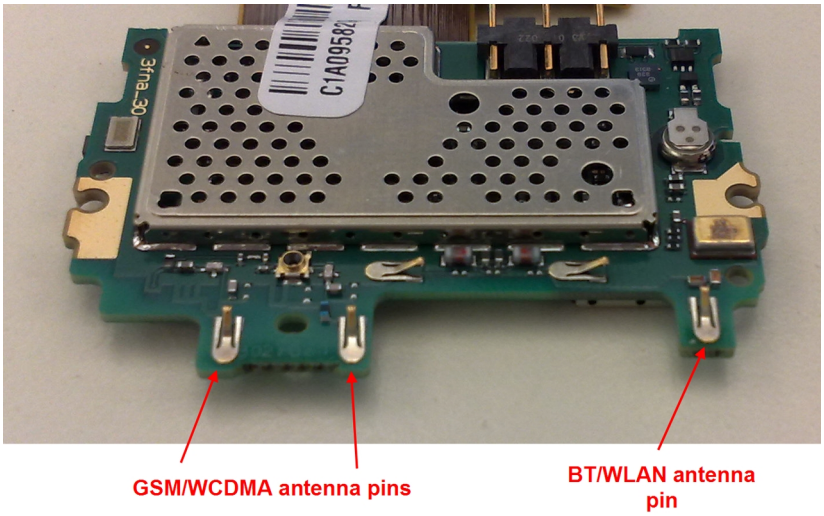


Figure 21 C-clip for BT/WLAN antenna

5 — System Module

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Table of Contents

List of Tables

List of Figures

Introduction

Phone description

RAPU is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE. Gazoo (N2200) is main audio and energy management controller for the phone.

Key components

Function	Description	Item ref
Main PWB	3fna	
Connector	3fpa	
UI flex	3fqa	
Baseband engine	RapuYama v1.13	D2800
Memory	1024NAND+512 Combo Memory	D3000
Energy Management ASIC	PEARL_J	N2200
RF ASIC	Älli	N7512
Oscillator	Xtal Oscillator	B7500
RX-SAW		Z7518
Vibra	Shaft vibra	M4000
Battery connector	Tabby blade interface	X2070
Backup Battery		G2200
32kHz crystal		B2200
Bluetooth/FM/WLAN	BOB1.0M-a	N6300
BT/WLAN Filter		Z6300
Charging connector		X4500
AV connector		X2500
AV amplifier		N2000
IHF amplifier		N2120
SIM reader		X2700
Micro-USB connector		X3300
USB transceiver	HS-USB-OTG	D3300
Micro-SD card reader		X3201
RF connector		X6402/ X6403
Touch PWB connector		X6000
Volume keys		S2550/ S2551
Capture key		S2500

Function	Description	Item ref
Lock key		S5252
Microphone		B2100
Display connector		X2420
Earpiece		B2100
Flash light controller		N1400

Key component placement

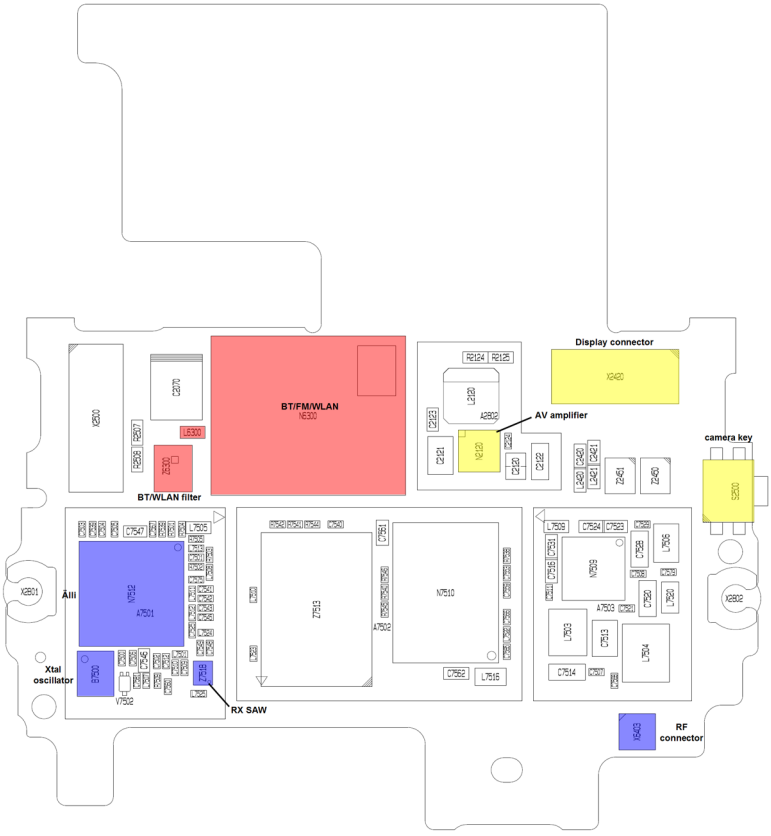


Figure 22 Top side of engine PWB

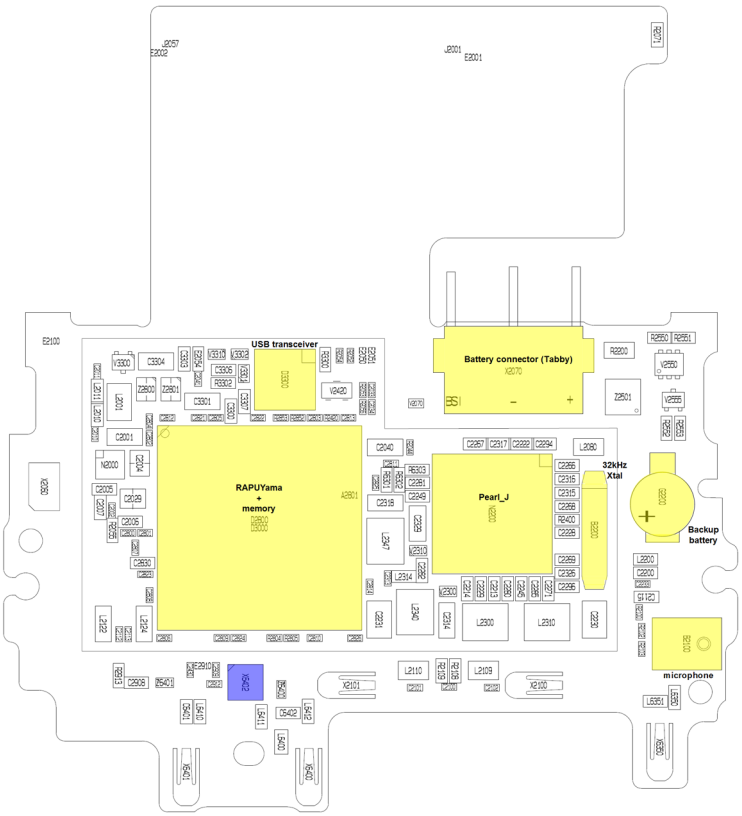


Figure 23 Bottom side engine PWB

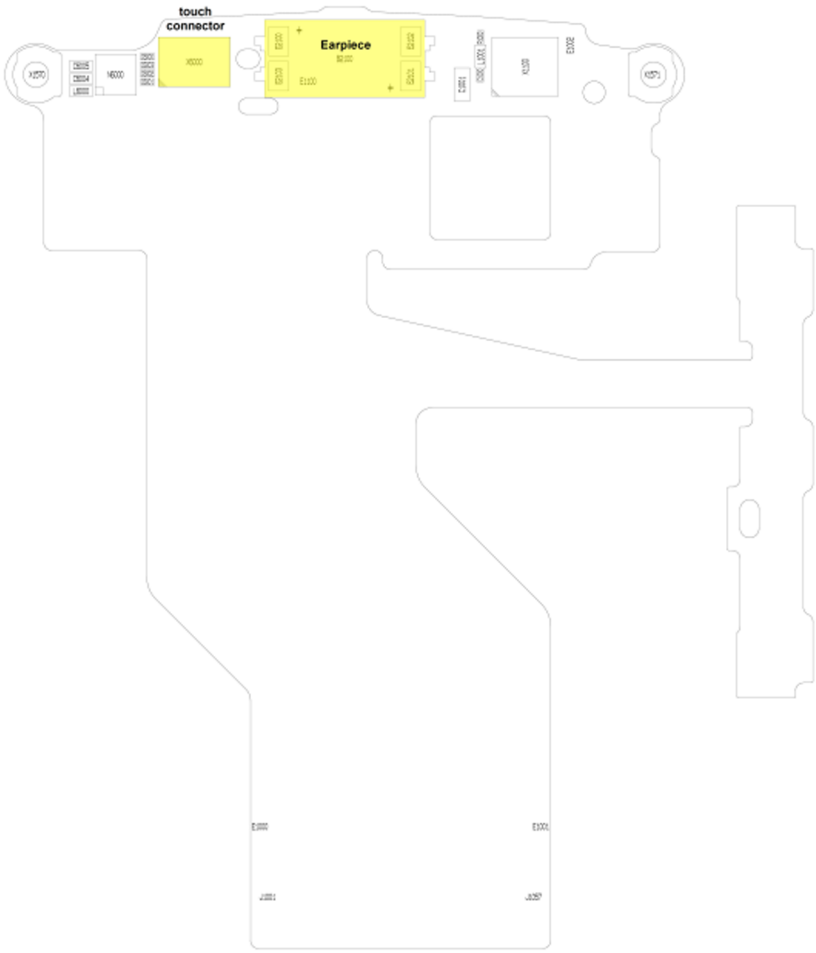


Figure 24 Top side of connector PWB

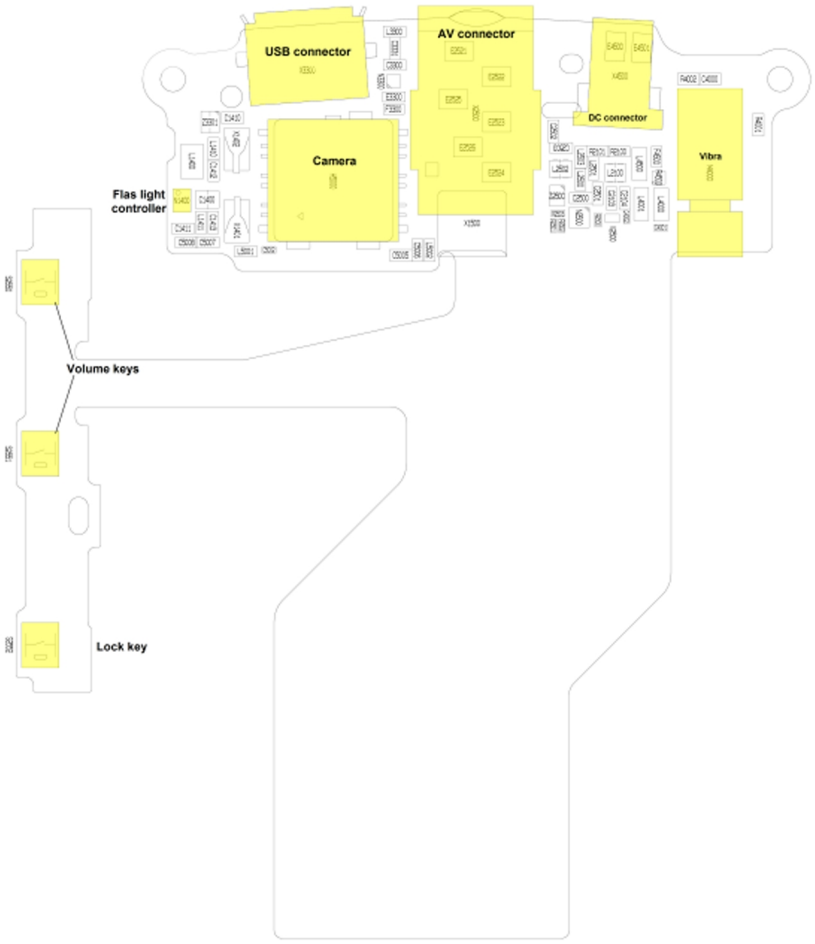


Figure 25 Bottom side of connector PWB

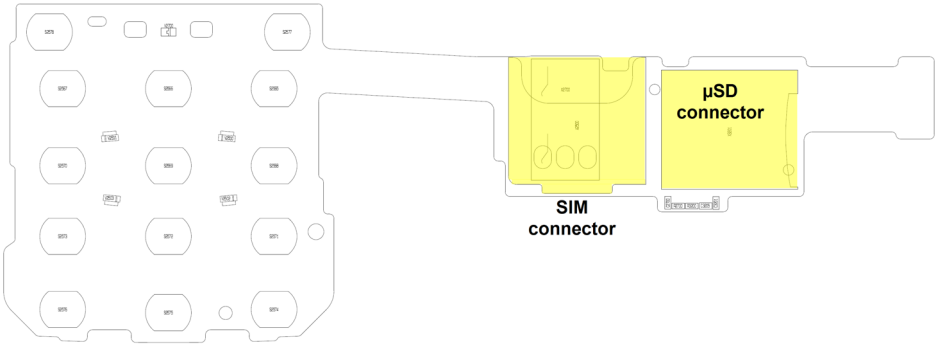
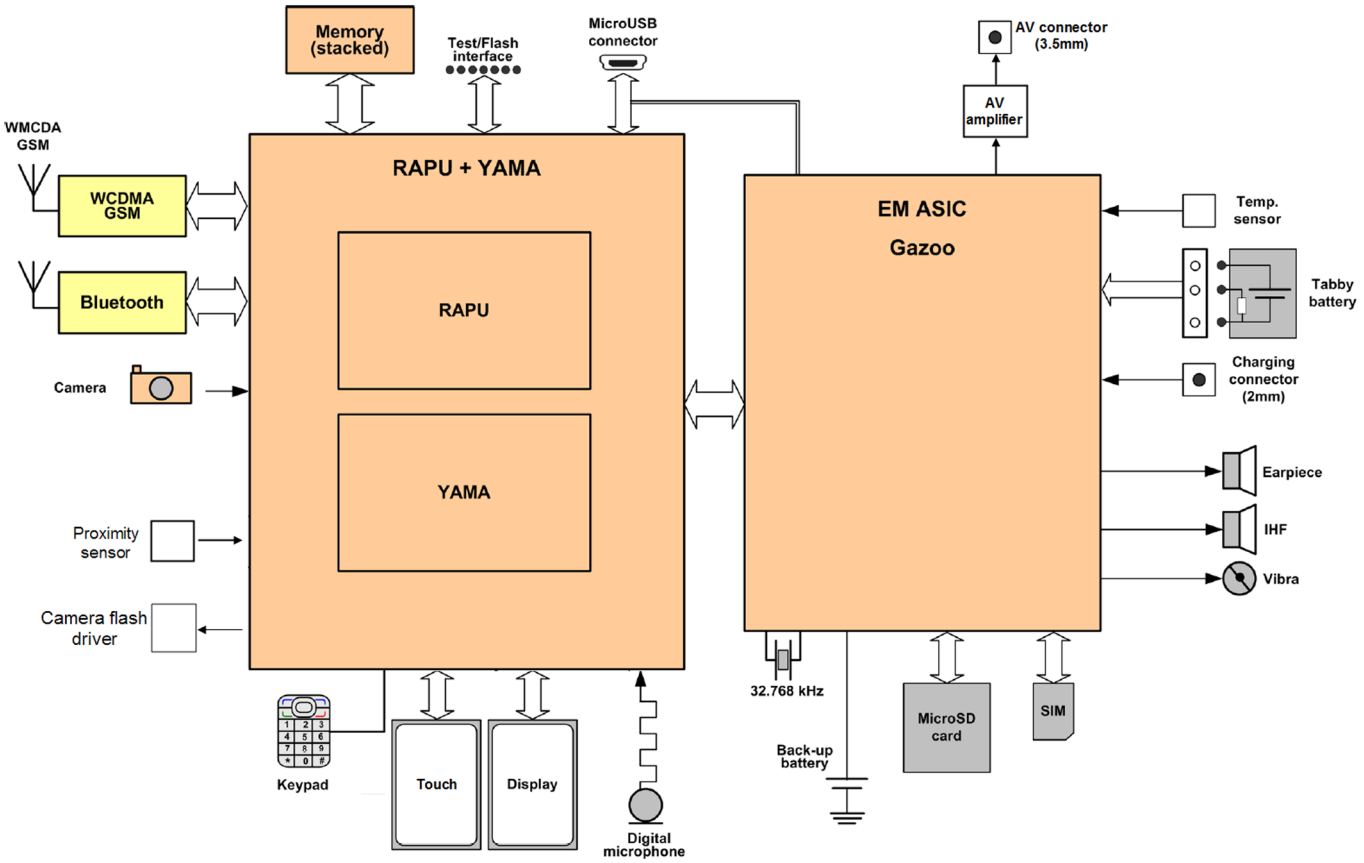
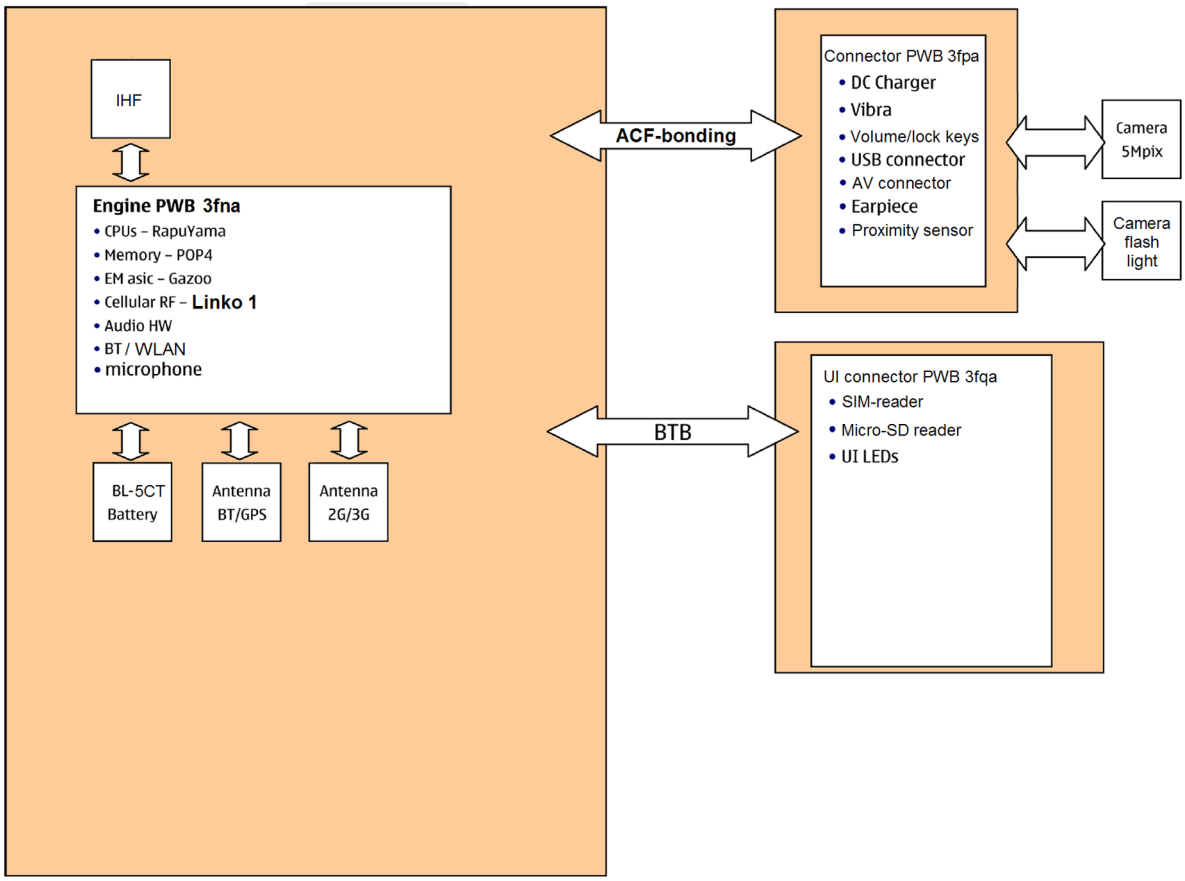


Figure 26 Top side of UI PWB

System module block diagram



Board and module connections



Energy management

Battery and charging

BL–5CT battery

The phone is powered by a 3-pole BL–5CT 1050 mAh battery (Li-Ion). The three poles of the battery are named VBAT, BSI and GND, where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

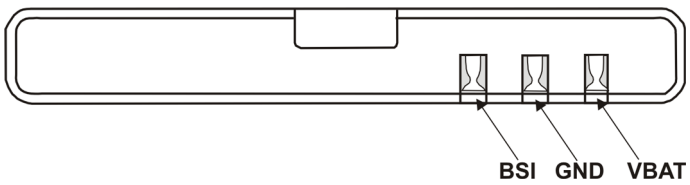


Figure 27 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line of EM ASIC (N2200). This resistor is located on the main PWB, at a place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

Figure 28 Blade battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger plug (3.5 mm) can be used together with a CA-44 charger adapter.

Figure 29 Small (right) and wide (left) charger plugs

The phone can also be charged via USB using CA-101.

Charging is controlled by EM ASIC (N2200), and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Charging a dead battery

Charging of a dead battery has to be carried out via an approved NOKIA charger. If the phone is charged via USB, CA-101 must be used.

Normal and extreme voltages

Energy management is mainly carried out in the EM ASIC (N2200). that contains a number of regulators. In addition there are also some external regulators.

In the table below normal and extreme voltages are shown when a BL-6Q battery is used.

Table 5 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	

Voltage	Voltage [V]	Condition
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone, the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again and the system is powered down with the aid of SW. The power key is connected to EM ASIC (N2200) via the PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(Dead) mode means that the main battery is not present or its voltage is too low (below EM ASIC master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over EM ASIC master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Clocking scheme

In BB5.44, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in the RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPU for low-power operation.

SMPS Clk is 2.4MHz clock line from RAPU to EM ASIC N2200. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

CLK600. The clock source is an internal RC oscillator in EM ASIC N2200 (during the power-up sequence) or RAPU SMPS Clk.

Bluetooth and WLAN have a separate 38.4MHz TCXO clock oscillator.

Power distribution

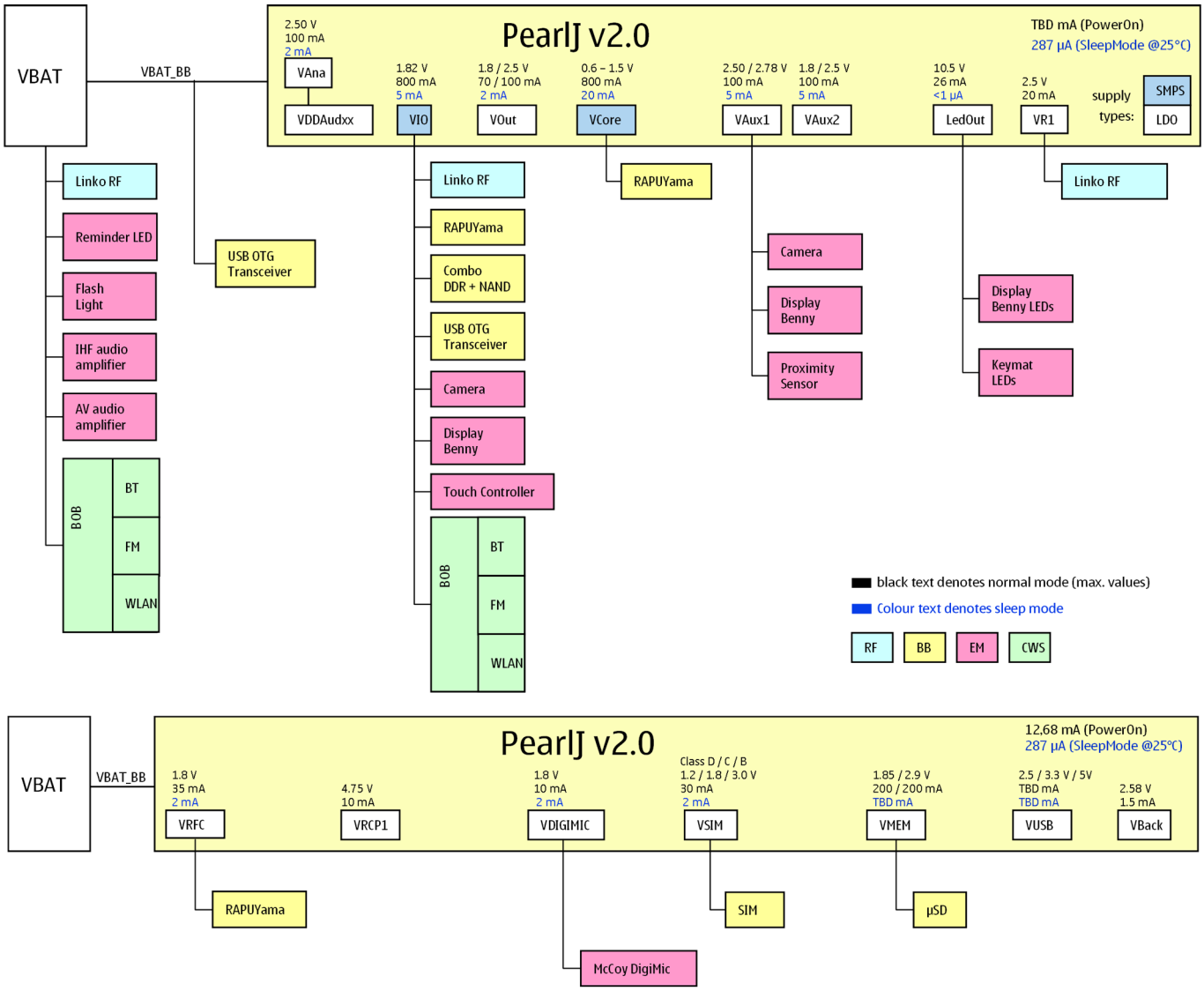


Figure 30 Power distribution diagram

SIM interface

The phone has a SIM (Subscriber Identification Module) interface including a SIM connector. The connector is only accessible when the battery is removed.

The SIM interface consists of an internal interface between RAPU and EM ASIC (N2200), and an external interface between EM ASIC and SIM contacts.

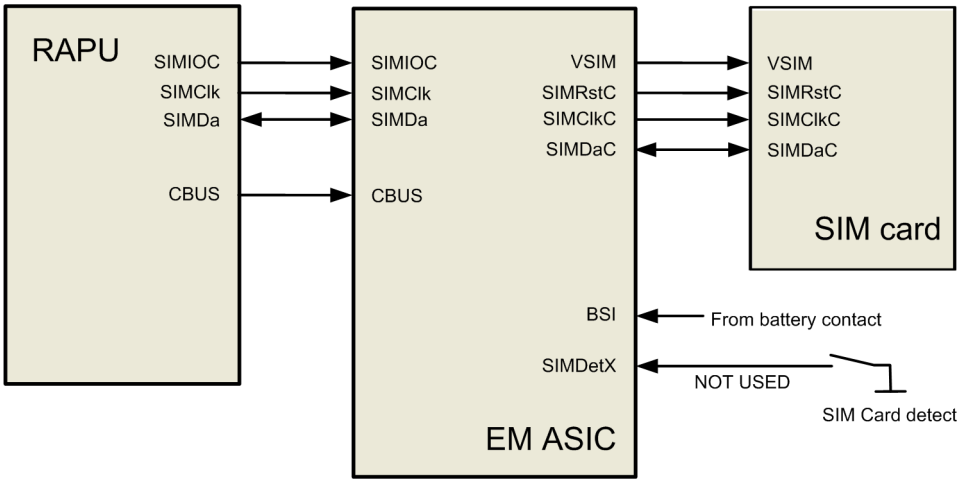


Figure 31 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based on the BSI line. Because of the location of the SIM connector, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8V and 3.0V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR (Answer to Request), a 3V interface voltage is used.

MicroSD card interface

The microSD card interface has one internal interface between RAPU and EM ASIC and one external interface between EM ASIC and the microSD card. The microSD card connector is mounted on a separate PWB, the Micro PWB.

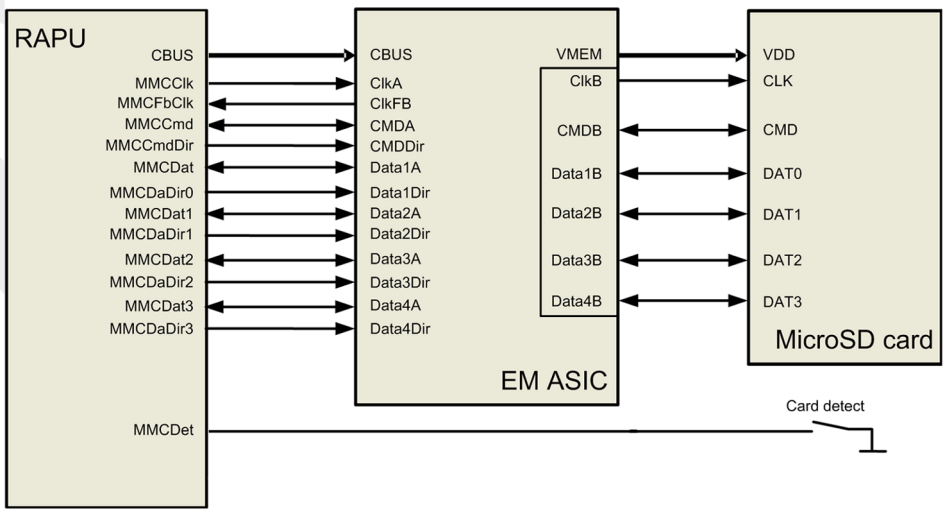


Figure 32 MicroSD card interface

USB

USB interface

The phone has an interface for USB (Universal Serial Bus). USB is a differential serial bus that provides a wired connectivity between the phone and, for example, a PC or a headset.

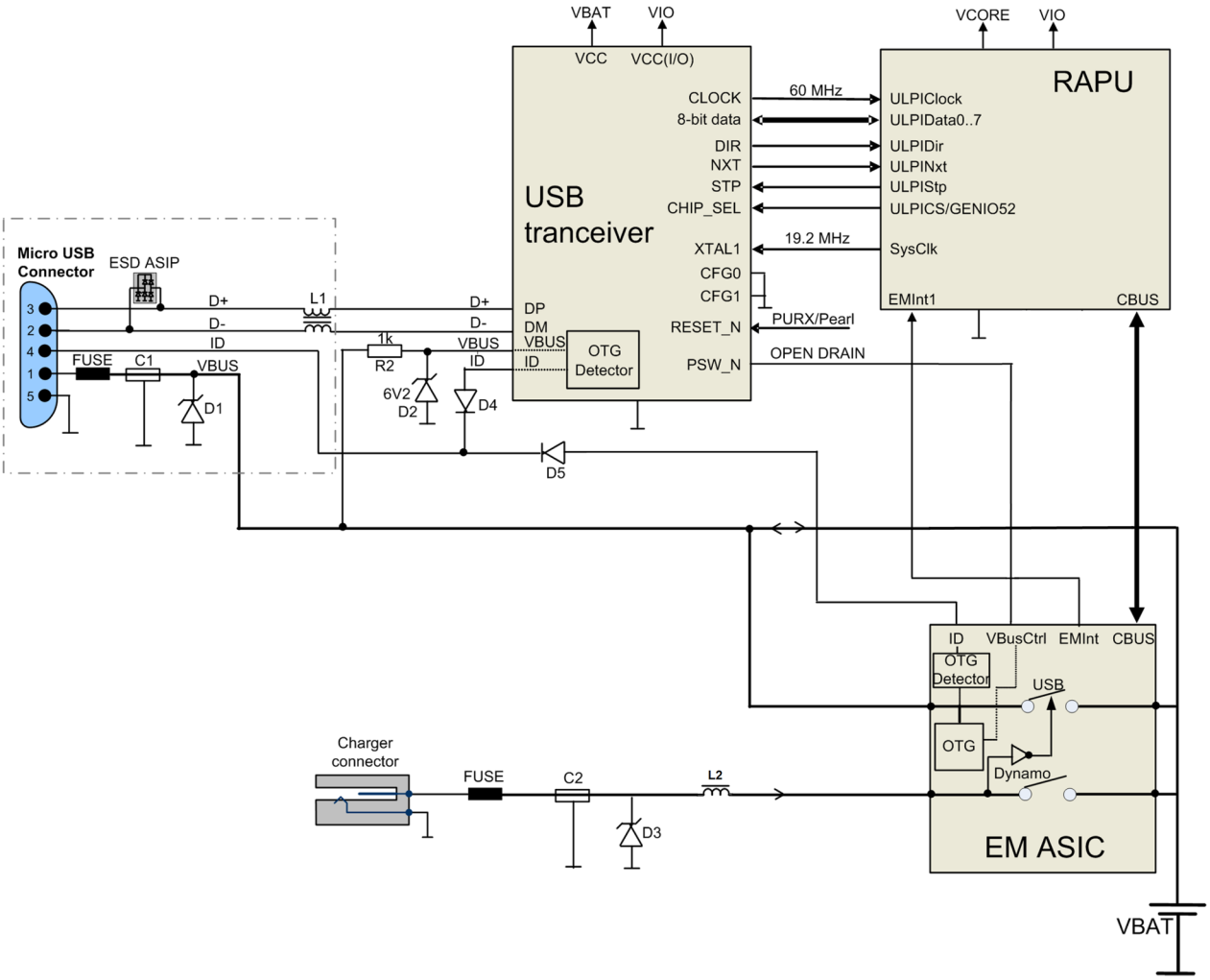


Figure 33 USB interface

The phone supports USB 2.0 with High-Speed (480 Mbps).

Hot swap is supported, which means that USB devices may be plugged in and out at any time.

MicroUSB connector

This phone is provided with a specific connector for microUSB.

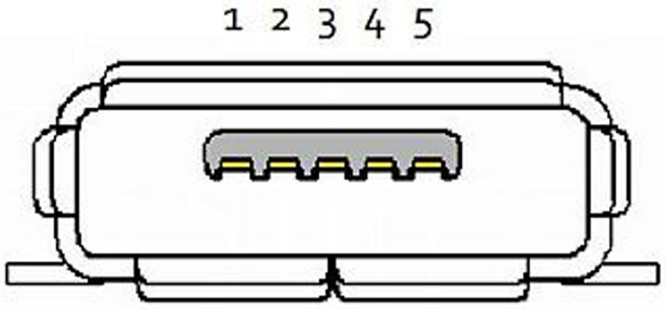


Figure 34 MicroUSB connector

User interface

Display interface

The following block diagram illustrates the display interface. Command signals and transmitted data to the display module comes directly from RAPU.

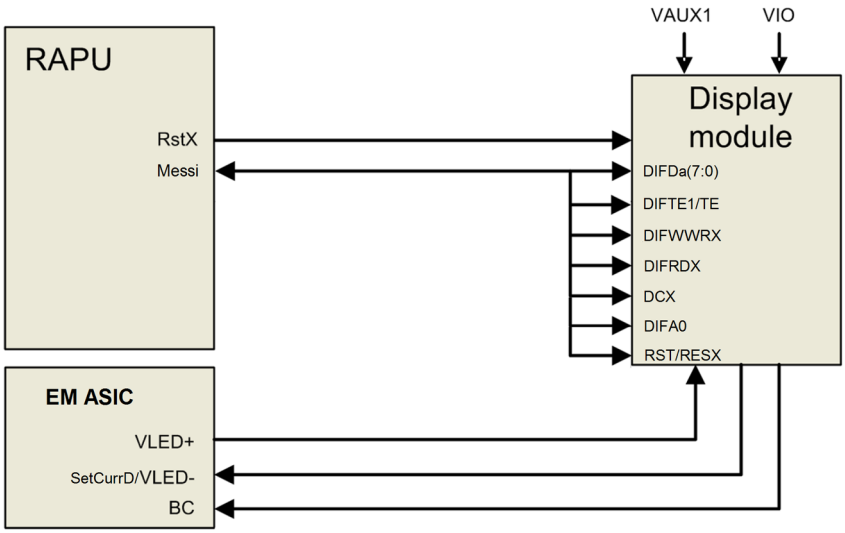


Figure 35 Display interface

Keyboard interface

All keys (main keyboard, media, messaging, volume, lock keys) are directly connected to GENIOs of the RAPU.

The main keypad LEDs are controlled by the EM ASIC.

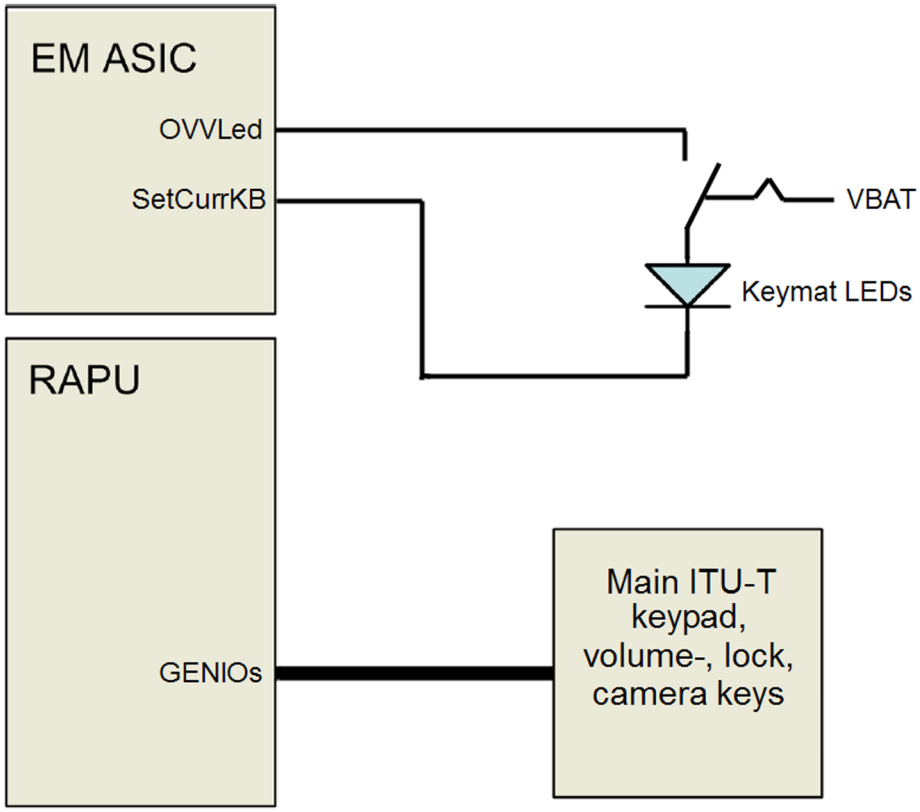


Figure 36 Keyboard interface

Camera interface

In this phone the camera is connected directly to RAPU and controlled by the I2C bus, port 0. The camera is supplied by VBAT and VAUX1.

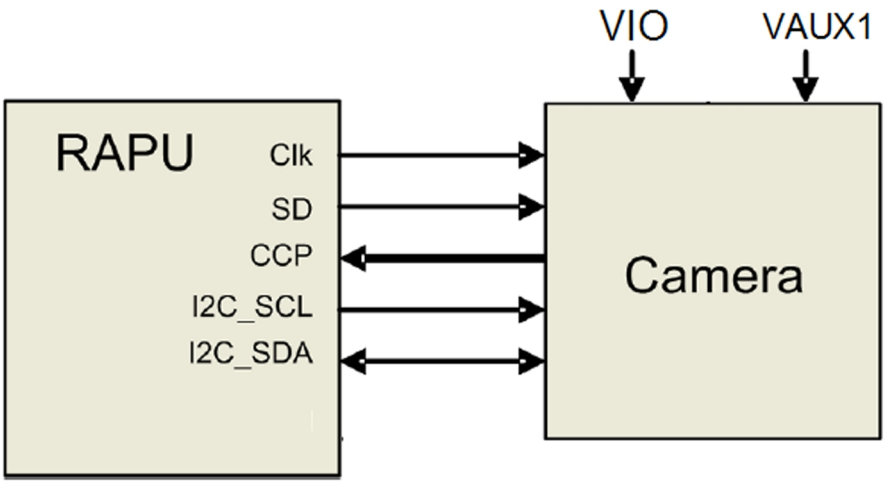


Figure 37 Camera interface

Audio interface

Mixed-signal ASIC PearlJ provides the analogue audio interfaces. RM-640/RM–662 is using the M-Stout earpiece. Mean IHF speaker with Boosted Amplifier Vallu is used for music playback, ringing tones and hands free speech.

RM-640/RM–662 has one digital Knopfler microphone and a Shaft Vibra. Headset support is available using a 3.5mm AV plug. BOB provides the FM Radio and BT signals.

The following block diagram illustrates the audio interface of the phone:

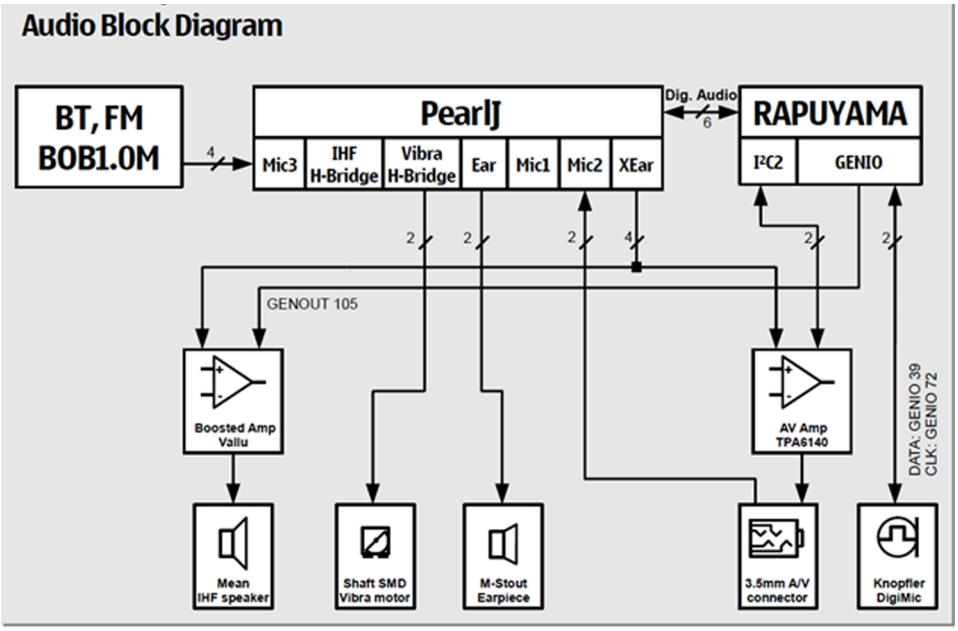
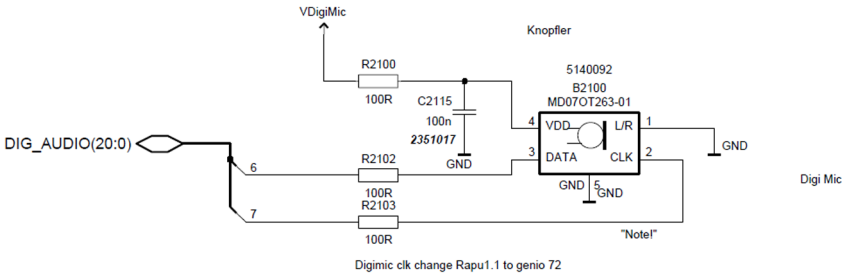


Figure 38 Audio interface

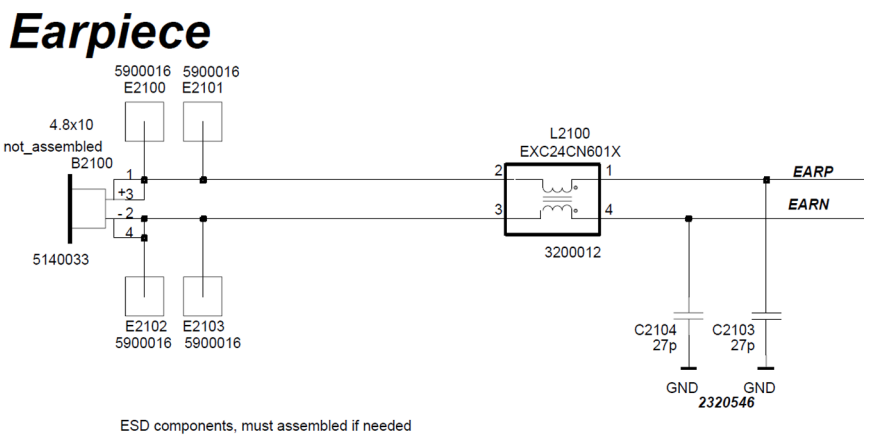
Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. The data and CLK line of the digital microphone are connected to RAPU and the operating voltage of 1.8V is supplied by the EM ASIC.

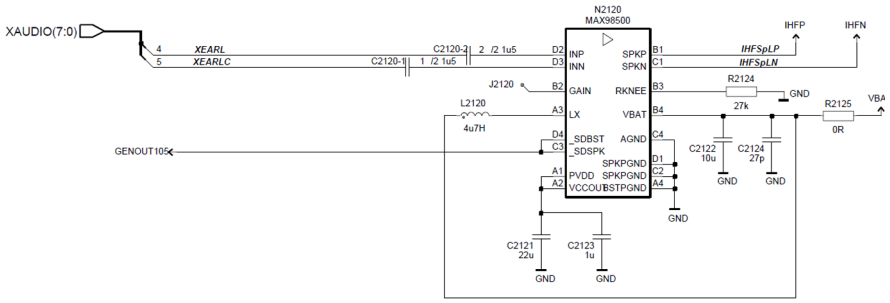


Internal earpiece

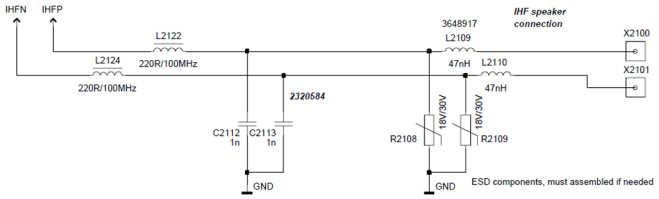
The internal earpiece used is M-Stout(4.8 x 10) and is connected to EM-ASIC EARP and EARN lines.



Internal handsfree (IHF) speaker



IHF- connection



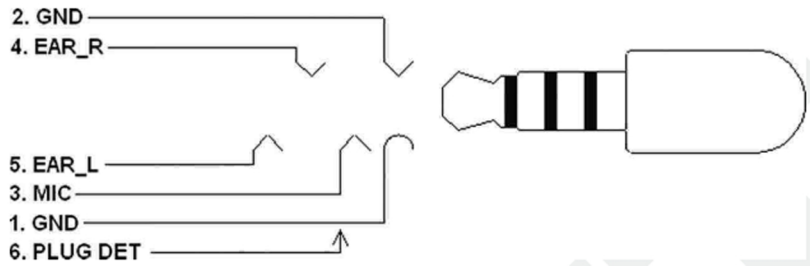
External earpiece and microphone

The AV headset earpiece is connected to TPA6140 (N2000) audio amplifier which is used for high quality audio output and to guarantee long playback time for accessory use. TPA6140 is connected to EM ASICs XEARl, XEARLC, XEARR and XEARRC for audio and is controlled by I2C2 bus of RAPU.

The AV headset microphone line is connected to EM ASICs Mic2 line.

AV connector

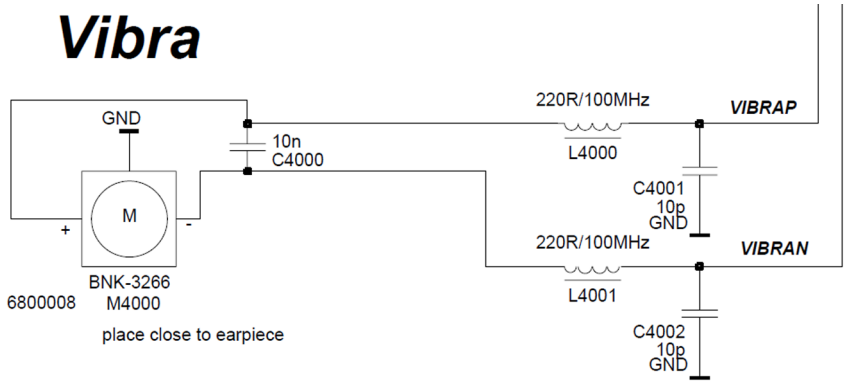
The AV connector handles audio signal output. It has audio left and right signals separately (pin 4 and 5) and the microphone signal wired to pin 3.



The plug detection signal handles the AV connector plug detection with HeadDet signal from EM ASIC.

Vibra

Vibra is located on the connector PWB and is connected to VibraN and VibraP lines of the EM ASIC.



Bluetooth interface

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the BTHFM module.

The BOB1.0M-a module provides full 802.11g,b & n WLAN, BT 2.1 + EDR, RM RDS.

From a troubleshooting point-of-view, WLAN is tested seperately but BT and FMRX are checked in parallel.

REFOUT_EXT1 single ended 38.4MHz analog clock from Linko RF is provided to BOB1.0M-a. The clock request for the reference clock in the BOB1.0M-a module is shared between WLAN and BTHFM blocks. When either system requires a clock, this signal will be actice. The CLK_REQ is connected to genio37 pin of RAPU. The SLEEPCLK input of 32.768KHz from EM ASIC is used for power management and for FM in lower power mode.

The internal SMPS supplies the whole BOB1.0M-a solution from the phone battery supply, VBAT, apart from VIO which is needed for interface signal reference levels.

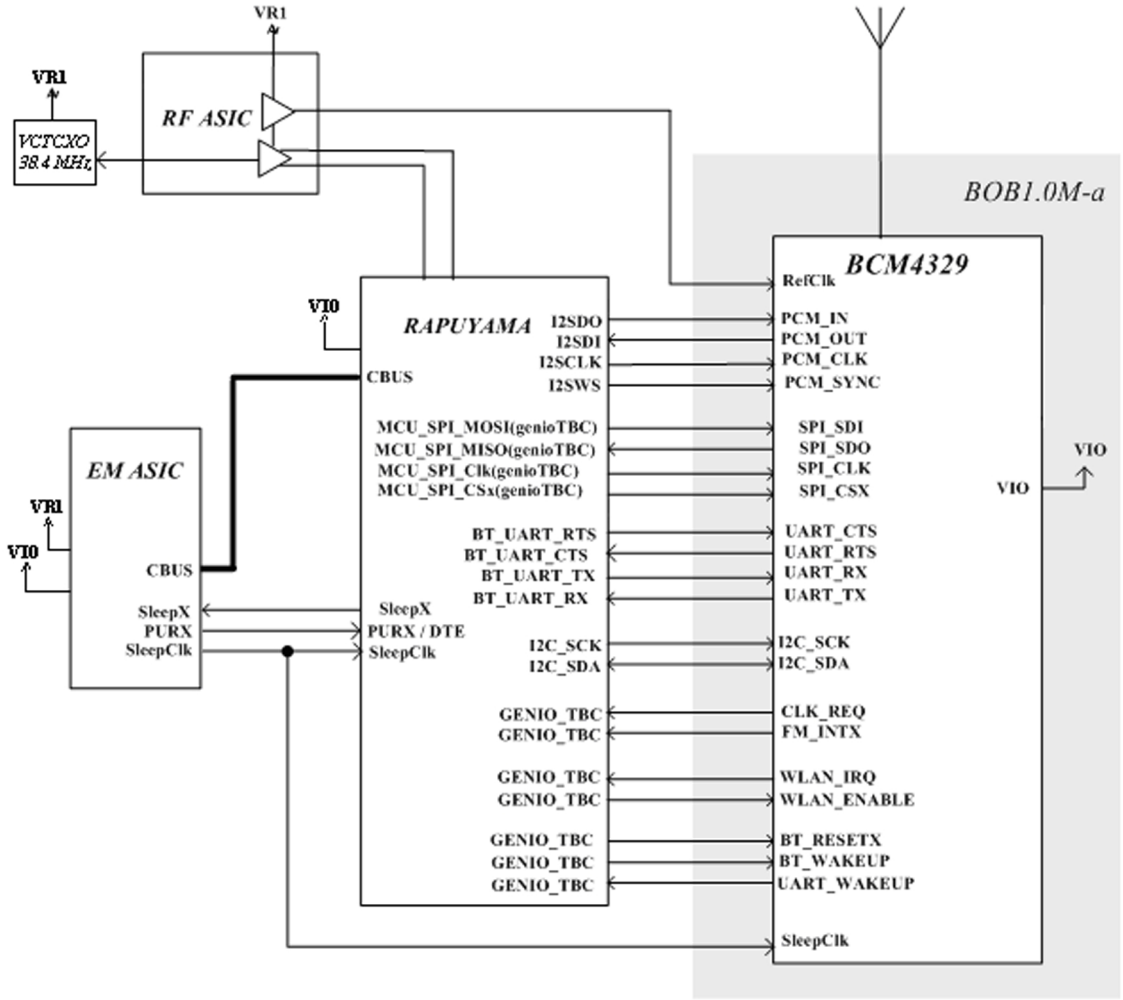


Figure 39 Bluetooth interface

RM-640/RM—662 is supporting Bluetooth, FM Radio (Rx) and WLAN.

Proximity sensor

The proximity sensor is used to turn off the touch input, when the phone is against user's ear during call. This prevents accidental touch signals that could happen when, for example, user's cheek touches the phone.

The main parts of the proximity sensor subsystem are:

- Proximity sensor
- Proximity boot (mechanical part)

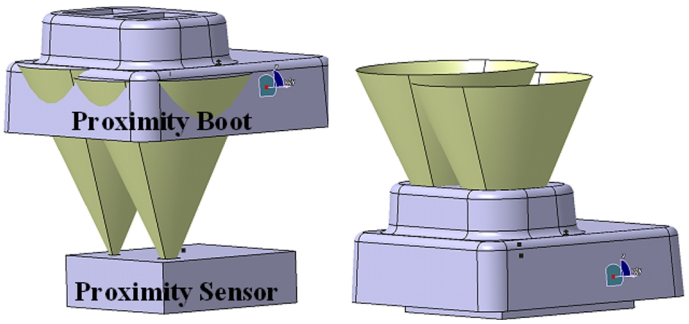


Figure 40 Proximity sensor and boot

The proximity sensor is located on the connector PWB.

Features

The Proximity sensor has following features:

- 2.8V
- 1.8V compatible IOs
- Low power consumption
- 20 mm working area
- Factory calibrated, no calibration required in care
- Pb free/RoHS compliancy

The proximity sensor works by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal. When the object is under 20 mm distance detection will happen and output will go to high state (1.8V).

Touch screen controller

TSC2004 (N6000) is a touch screen controller for resistive touch pads. It contains a complete ultralow-power, 12-bit, analog-to-digital (A/D) resistive touch screen converter, including drivers and control logic to measure touch pressure.

It also has embedded pre-processing function to reduce the output bus load. The host interface in TSC2004 is I2C.

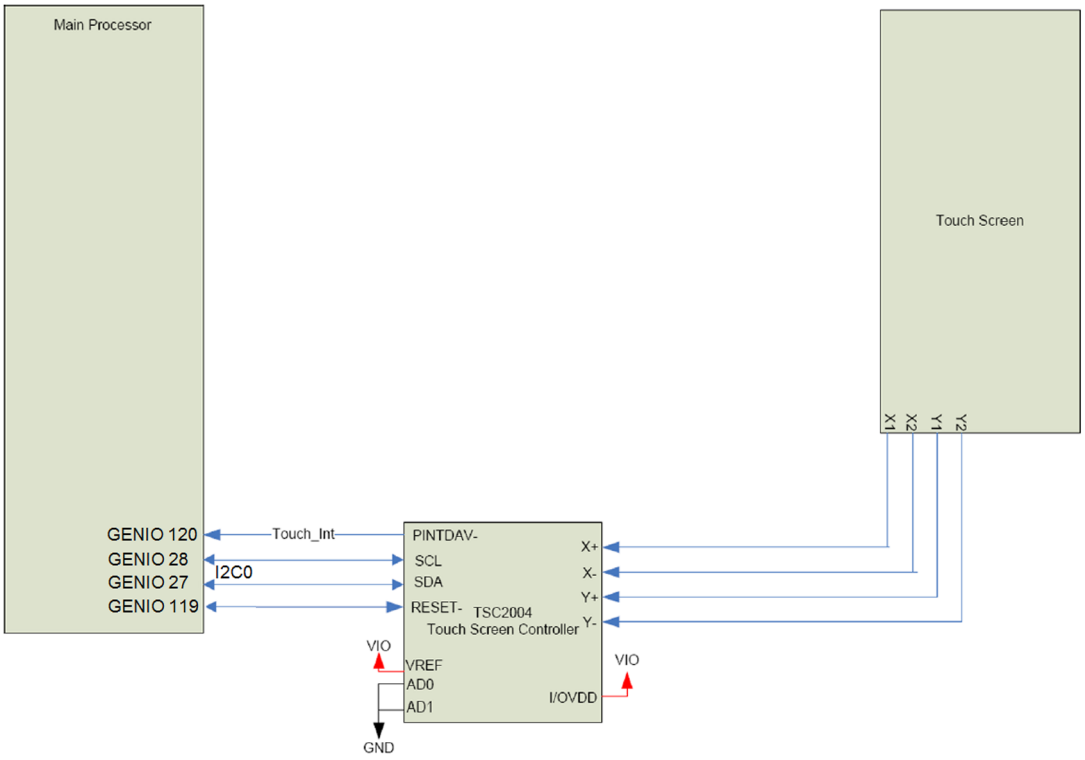


Figure 41 Touch screen controller

Cellular RF technical description

RF block

Linko RF consists of the following key components:

- Älli (Transceiver RF Asic)
- Aura (RF power management Asic)
- Ukko PA
- QuBBE (Front end module)

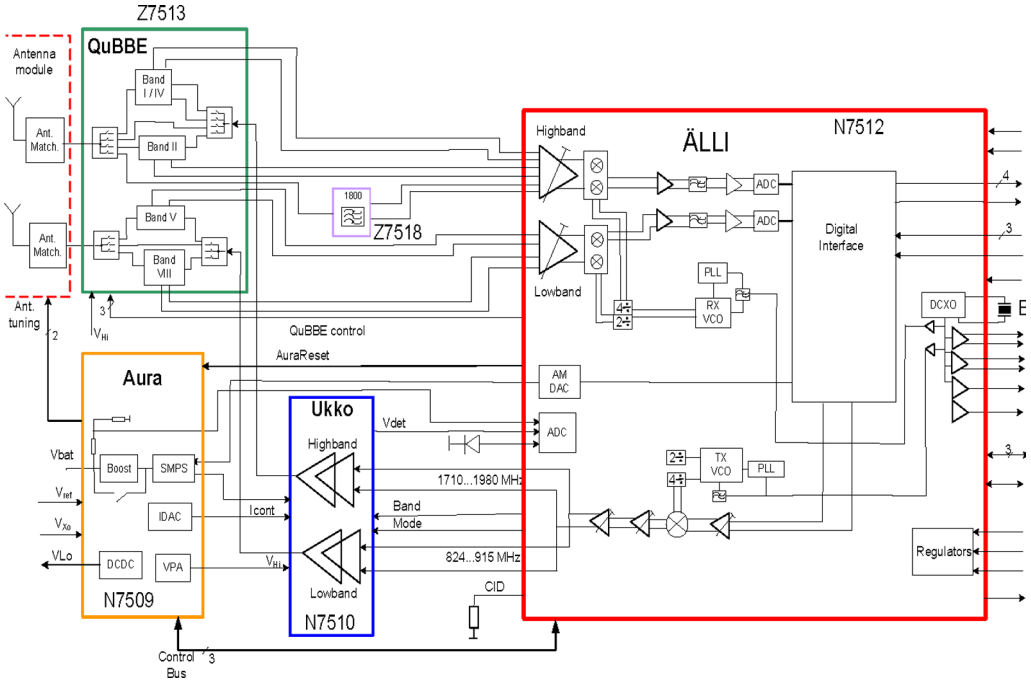


Figure 42 Linko RF block diagram

The RF block uses RF ASIC N7512 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

QuBBE

The front end module called QuBBE contains the needed front end filters and the switches. QuBBE contains:

- 3 duplexers (Band II, V, VIII)
- 1 triplexer (Band I, IV)
- 12 switches with the control
- Low and high band GSM TX low bass filters
- 50 ohms low and high and antenna interface

The control signals for the switches come from Älli.

Receiver (RX)

Linko RF has higher integration level compared to previous RF generations and especially more digital design blocks have been integrated to Älli, RF Asic.

Älli contains the receiver chain from LNAs to digital base band interface. Digital RX baseband interface contains four data and one clk signals. The data rate and clock frequency depend on the use case.

The main blocks in Älli are:

- LNAs: Balanced inputs for 850, 900, 1800, 1900, 2100 bands
- Passive mixer
- Analog baseband: Programmable for different modes

- ADC: Programmable Sigma Delta Modulator topology ADC
- RX Digital Front End (RXDFE): Contains for example digital filtering, DC offset compensation, wide/ narrowband power measurement blocks

There is integrated external LNA matching on the bands 900, 1800, 1900 and 2100. On 850 band, there is an integrated matching.

Synthesizer

The synthesizer has separate highly integrated 4GHz VCOs for RX and TX. The integrator capacitors of the loop filter are outside of the IC. The PLLs are fractional type of dividers.

The reference oscillator is an on-chip 38.4 MHz digitally controlled oscillator. The 38.4 MHz crystal is outside of Älli. DCXO delivers the internal clock to Älli, differential clock signal to BB, and two single mode clock signals to NCW modules. Älli delivers a clk signal to diversity RX. The oscillator is controlled via RFBus with AFC signal. Temperature compensation of the oscillator is running by the SW in Älli. The temperature sensor itself is outside of Älli.

Transmitter (TX)

The main features of Linko1 transmitter are:

- Common PA for GSM and WCDMA
  - High and low band signal paths
    - Low band: 824 - 915 MHz
    - High band: 1710 - 1980 MHz
  - Two operation modes in PA
    - Saturation mode in GMSK usage
    - Linear mode in Edge and WCDMA usage
- No TX filter between PA and Älli
- Common regulators for GSM and WCDMA
  - Boost and SMPS regulators in Aura
    - Feeding the supply voltage to PA
    - Operation frequency varies depending on the used system

Frequency	SMPS	Boost	DCDC
WCDMA	3.0 MHz (typ)	4.5 MHz (typ)	1.3 MHz (typ)
GSM	9.5 MHz	7.5 MHz	2.7 MHz

- Digital interface to baseband
  - WCDMA mode
    - Digital IQ interface
    - 3 data and 1 clk signals
  - GSM mode
    - GSM TX data bits are sourced from baseband via RFBus to Älli

In GMSK mode, the output level of Älli is kept high with all power levels, and the output power is adjusted by altering the collector voltage of PA. In practice, the output level of Älli is also slightly changed (optimized) in the highest power level to keep the PA compression level more constant, which results in better overall efficiency and performance.

In WCDMA and EDGE mode, the output power is tuned by output level of Älli. The supply voltage in WCDMA mode is adjusted in power levels to optimize the current consumption.

6 — BOB (WLAN/FM/BT)

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Table of Contents

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Troubleshooting Guide

BOB (WLAN/FM/BT) Troubleshooting Guide Description

Introduction

The BOB1.0M-a module supports WLAN, BTH and FM RX. From a troubleshooting point of view, WLAN is tested separately, but BTH and FMRX is checked in parallel.

Test point details

Required for de-bugging and customer care:

- J6300 CLK_REQ
- J6302 REFCLK_I
- J6303 BT_RESETX
- J6301 WLAN_ENABLE

Symptom, Problem and Repair Solution

The following problems can occur with the WLAN, Bluetooth and FM radio hardware:

Symptom	Problem	Repair Solution
Unable to switch on WLAN on phone user interface	Open circuit solder joints or component failure of BOB module.	Replacement of BOB module or Host.
Able to turn on WLAN via phone user interface, but unable to detect any WLAN APs or other WLAN devices.	Open circuit solder joints or component failure of BOB module or Filter.	Replacement of BOB module or Filter
Able to turn on WLAN via phone user interface, and find AP's and other WLAN devices, but not able to connect.	Problem with TX part of WLAN circuit	Replacement of BOB module
Slow download speed when using WLAN as connection method.	System clock possibly degraded.	Change system clock source.
Unable to switch on Bluetooth on phone user interface	Open circuit solder joints or component failure of BOB module or SMD components.	Replacement of BOB module
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset	Open circuit solder joints or component failure of BOB module (PCM interface).	Replacement of BOB module
Able to turn switch on Bluetooth on phone user interface, but unable to detect other Bluetooth devices	Open circuit solder joints or detected component in Bluetooth antenna circuit.	Repair of Bluetooth antenna circuit

Symptom	Problem	Repair Solution
Problems connecting to specific manufacturer/model Bluetooth accessory (specific Bluetooth profile supported by phone and accessory in product specification)	Possible interoperability issue with accessory fixed in recent Nokia phone software release (check Nokia Service Bulletin for latest information)	Update phone software to latest version if advised in Nokia Service Bulletin Note: The phone Bluetooth Address and software version are displayed by pressing *#2820# when Bluetooth is on.
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with FM headset inserted	Open circuit solder joints or detached component in FM receiver antenna circuit.	Repair of FM receiver antenna circuit
Able to perform scans to detect local FM radio stations with functional FM headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM receiver audio path between Bluetooth/FM ASIC and headset.	Repair of FM audio circuit

Users may experience the following problems resulting in functional phones being returned to the repair centre:

Symptom	Problem	Solution
WLAN does not operate as desired with another WLAN device	Other WLAN device is not conforming to ETSI/FCC specifications	Use only certified WLAN products.
Bluetooth feature does not operate as desired with another Bluetooth device	Bluetooth Profile implemented in Bluetooth accessory not supported in Nokia phone	Use Bluetooth accessory with Bluetooth profiles supported by phone
Poor FM radio reception (unable to detect many radio stations)	Nokia headset not being used.	Use Nokia headset

Test Coverage

The tests listed in the table below should be performed to verify whether the WLAN, Bluetooth and FM receiver are functional.

As Bluetooth, FM receiver, and WLAN share the same ASIC, all of these functions should be re-tested after repair to the Bluetooth-FM-WLAN circuit (if supported by the phone).

Test	Test Coverage	Repair Solution
WLAN Self Test: *ST_WLAN_TEST*	WLAN SPI and control interface (Data interface and control of WLAN)	Replacement of BOB
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device	Antenna connection from module, including filter.	Replacement of BOB or antenna components

Test	Test Coverage	Repair Solution
WLAN TX Tuning	Checks WLAN TX path up to module output.	Replacement of BOB or antenna components
Bluetooth Self Test: *ST_LPRF_IF_TEST*	Bluetooth-FM ASIC UART interface (controls Bluetooth and FM receiver and transmitter)	Replacement of BOB module (or repair of phone BB)
Bluetooth Self Test: *ST_BT_WAKEUP_TEST*	Bluetooth ASIC interrupt control interface	Replacement of BOB module (or repair of phone BB)
Bluetooth Self Test: *ST_LPRF_AUDIO_LINES_TEST*	Bluetooth ASIC PCM interface	Replacement of BOB module (or repair of phone BB)
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device	Bluetooth antenna circuit	Repair of Bluetooth antenna circuit (including RF filter or WLAN switch if fitted)
FM Radio Functional Test: Perform scan for local radio stations and check station list displayed on phone	FM receiver antenna circuit	Repair of FM antenna circuit (between BTHFMWLAN ASIC and headset connector)
FM Radio Functional Test: Listen to local radio station	FM receiver audio circuit	Repair of FM receiver audio circuit (between BTHFMWLAN ASIC and headset connector)

The self tests run from Phoenix software are used for fault diagnosis.

If Phoenix software is not available the functional tests with phone accessories are sufficient to verify the function of WLAN, Bluetooth and FM radio receive.

If radio reception is poor inside the service centre buildings, the FM receiver can be tested using another FM transmitter device connected to a music player.

Test Procedure--Phoenix Service Software Set up

WLAN Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product** .
4. From the Mode drop-down menu, set to **Local**.
5. Choose **Testing Self Tests**.
6. In the *Self Tests* window check the following WLAN tests:
   - *ST_WLAN_TEST*
7. To run the test, click *Start*.

Bluetooth Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product** .
4. Select **Bus Method** (FBUS or USB) from "**Connections**" box.
5. From the Mode drop-down menu, set to **Local**.
6. Choose **Testing Self Tests**.
7. In the *Self Tests* window check the following Bluetooth tests:
   - *ST_LPRF_IF_TEST*
   - *ST_LPRF_AUDIO_LINES_TEST*
   - *ST_BT_WAKEUP_TEST*
8. To run the test, click *Start*.

FM Receiver Self Tests

The self test *ST_FM_RADIO_TEST* used on previous phone designs is not available. As Bluetooth and FM radio share the same control interfaces, FM radio control interfaces are tested using the Bluetooth Self Tests.

Bluetooth BER Test

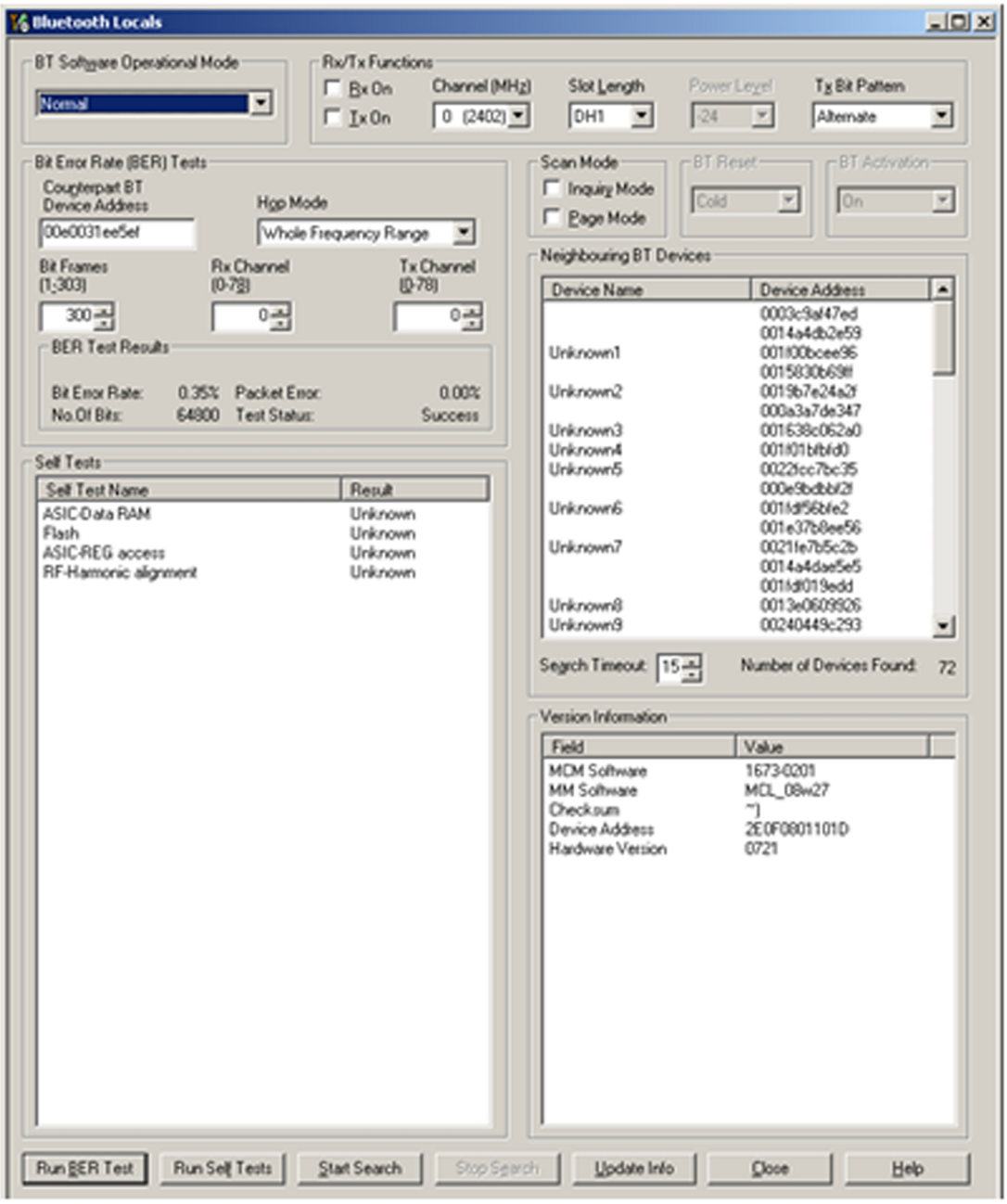
Context

SB-6 Bluetooth test box (BT-box) is required to perform a BER test. If a BT-box if not available Bluetooth functionality can be checked by transfering a file to another Bluetooth phone.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product** .
4. Choose **Testing Bluetooth Locals**.
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the SB-6 Bluetooth test box.
6. In the *Bluetooth Locals* window, write the 12-digit serial number on the *Counterpart BT Device Address* line.

7. Place the BT-box near (within 10 cm) of the phone and click *Run BER Test*.



Troubleshooting

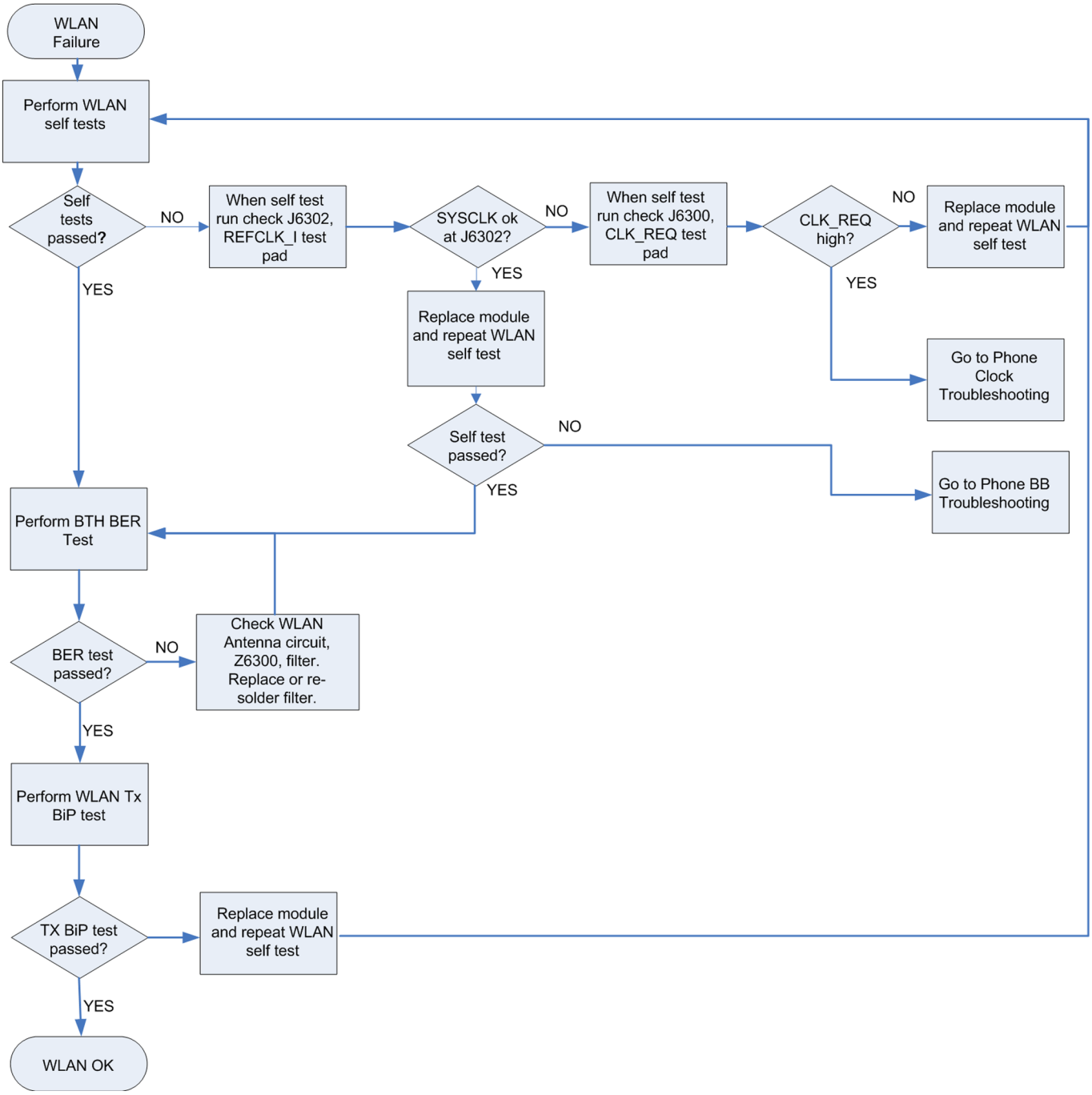
General Description

The specific troubleshooting fault repair chart only needs to be followed if there is a fault with a particular function.

The Bluetooth and FM radio receiver functions are combined so these features are all checked when troubleshooting (if supported).

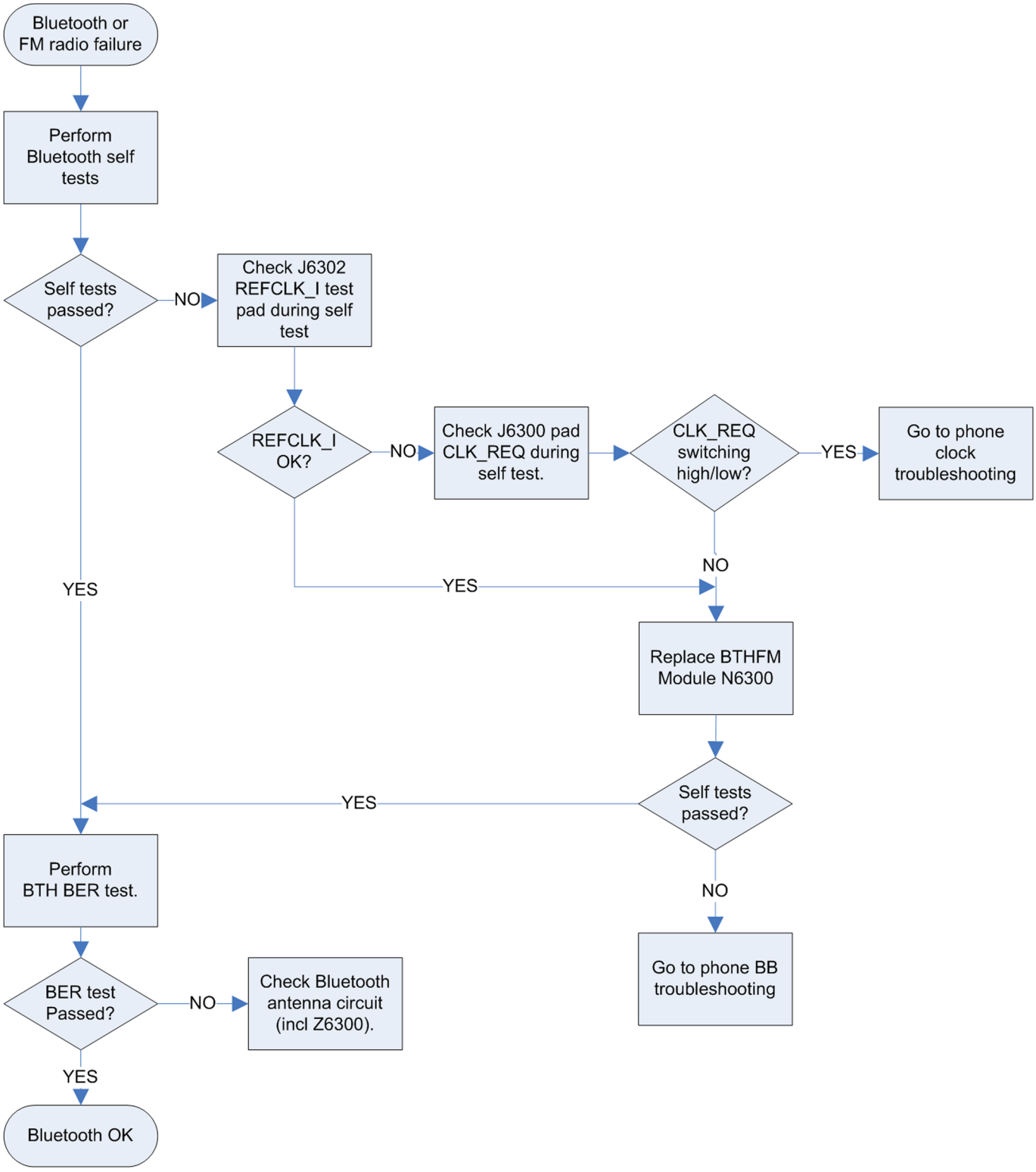
WLAN Troubleshooting

Troubleshooting flow



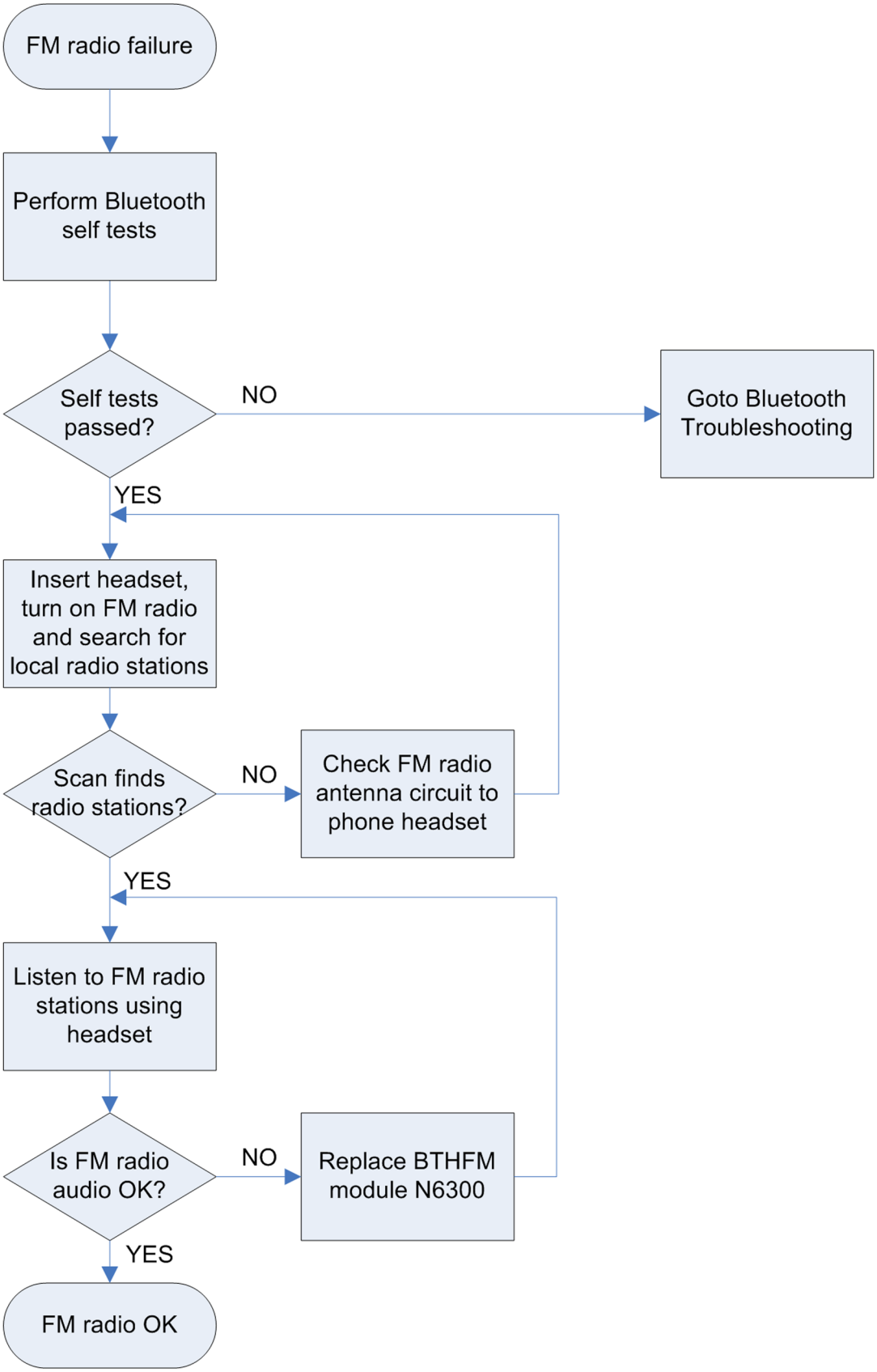
Bluetooth Troubleshooting

Troubleshooting flow



FM Receiver Troubleshooting

Troubleshooting flow



Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FM	Frequency Modulation
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity

IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MP3	Compressed audio file format developed by Moving Picture Experts Group
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PCM	Pulse Code Modulation
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board

PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RDS	Radio Data Service
RF	Radio Frequency
RF PopPort ™	Reduced function PopPort ™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC

USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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